# ON THE MINING OPERATIONS OF THE ANCIENT ROMANS, WITH SPECIAL REFERENCE TO BLAST FURNACES.[1]

By the REV. JOSEPH HIRST.

As the Romans gradually extended their conquest over the world, they became more and more aware of the immense increase to their wealth that might be derived from skilfully conducted mining operations. Indeed the desire to obtain possession of such countries as yielded most abundantly the various metals that were required for objects of use or luxury seems to have led them to push their conquests in certain specified directions rather than in others.[2]

Spain, a country of gold and silver mines, has been called the Indies of the Old World. As, then, Tyre and Carthage had sent Phœnician colonists to establish their factories all along the coast of Africa as far as the Atlantic, who, having crossed over into Europe, settled along the far-stretching shores of Spain, and according to an ancient tradition, pushed their trading outposts as far as the British Isles ; so the Romans poured into Spain and reaped there the benefit of their discoveries, and of the labours of those who had been before them in the field.[3] Tunnelings of a Phœnician origin may still be seen in that country, and there the Romans found mines of gold, silver, lead, copper, tin, mercury, iron, sulphur, and salt.

[1] Read at the Meeting of the Institute at Newcastle, August 6, 1884.

[2] Tacitus, in his *Germania*, notes the absence of metals amongst the rude inhabitants of the north, but in the *Restitution of Decayed intelligence by the studie and travel of R. Verstegan*, that ingenious author was able to say of his beloved Germanie, "The mynes whereof Tacitus seemed doubtfull, do deliver gold, silver, copper, and other metalls ; yea the rivers do yeeld gold in the sand on their shore sides." (London 1628, p. 5.)

[3] Camden thought the Iberi, so-called, according to the Hebrew derivation, because they were *miners*. (Brit. xxxvi.) In earlier times Semiramis had employed prisoners of war to work in subterranean mines.

During the Republic, the State did not occupy itself much with the management of mines, upon which it looked with some disfavour, but left them chiefly to the care of private enterprise. Very little is known about the principles which, at that time, guided the policy of the Romans in this regard. To one who reads the thirty-third book of the Natural History of Pliny, it might appear that indifference to wealth and compassion for their fellow creatures were at the bottom of this disfavour, shown by the Romans in their early history for the work of mines. Various proofs in support of this theory are collected by Barba in his *Metallurgie* (*Tome* I, p. 430). Certain it is that after the conquests of foreign lands, it was altogether forbidden to work mines in Italy, the mother country. Yet it is remarkable that Pliny should consider Italy the richest country in the world for mineral wealth. *Metallorum omnium fertilitate nullis cedit terris. Sed interdictum id vetere consulto patrum, Italiae parci jubentium.* (H.N. *l.* iii., *c.* 24.) *Italiae parci vetere interdicto patrum, diximus alioqui nulla fecundior metallorum quoque erat tellus. Extat lex censoria Ictimulorum aurifodinae, Vercellensi agro, qua cavebatur, ne plus quinque millibus hominum in opere publicani haberent.* (*Ib. l.* xxxiii, *c.* 21.)

However much frugality, sobriety, simplicity of manners and disregard for luxury may have been virtues practised by the Romans in the early days of the Republic, they but too often yielded in later times to sentiments of a different order. It has been surmised that the restriction limiting the number of men to be employed in the mines of Vercellæ to five thousand, so that no more should be employed in the works at one time by the public contractors, was to prevent the latter from exhausting these mines under the terms, and by the force of one agreement. Similar restrictions may have been suggested for similar reasons. Thus it was forbidden by a decree of the Theodosian code (*lib.* x, *tit.* 19, *leg.* 6, *Si qua navis*) to export silver from the rich mines of Sardinia on to the mainland.

In course of time, however, the greed of gold, so much inveighed against by the Roman moralists, became universal throughout the empire. Mines and public works of all sorts were seized upon, monopolized and administered

by the State through the agency of public farmers, called technically *Publicani*. In the days of the Republic, however, only the more important mineral products, whether in Italy or in the provinces, were claimed as belonging to the State. Amongst the works, at that time in the hands of the Government, were, says Marquardt,[1] the gold mines near Vercellæ, in northern Italy, employing, as already stated, five thousand hands; the silver mines near Nova Cartliago in Spain, where ten thousand men were employed, and where the daily output was reckoned at a value of twenty-five thousand denarii, the gold and silver mines in Macedonia, and the tin and lead mines near Sisapon, in Baetica, the modern Almaden in Andalusia. The same fate fell to the lot of a great many other mines, which, when let out by the revenue officers,[2] to those who thus came to farm them, were deemed capable of yielding a goodly income.

The greater portion, however, of the mines throughout the Roman dominion were still left in the hands of private speculators. In fact, the heavy rent paid by private works was more profitable to the State than the lesser and more precarious sums paid by the *Publicani* or public farmers. *Pacata provincia vectigalia magna instituit ex ferrariis argentariisque; quibus tum institutis, locupletior in dies provincia fuit*, says Livy, speaking of Spain at the time of Cato, B.C. 195 (*l.* xxxiv, *c.* 21).

Livy makes the express statement concerning the iron and copper mines in Macedonia, that they were to be left in the hands of the provincials; while of the gold and silver mines, he says, that on the formation of that country into a Roman province, they were altogether closed, though it is related that some ten years afterwards they were re-opened and let out in the ordinary way through the *Censores* to several *Publicani*.[3]

[1] Romische Staatsverwaltung, iiter Band, s. 245.

[2] These were the *Censores* who sat in Rome and put up the mines to auction and gave them to the highest bidder, who thus became a *Publicanus* or public farmer. Dion Cassius reckons on the goodly income to be derived from mine-rents: ὅσα ἐκ τε μεταλλείας . . , . . . δύναται προσίεναι (Lii., 52, 28).

[3] In the year 158 before Christ, in the decree of the Roman Senate, we read: *Metalli quoque Macedonici, quod ingens vectigal erat, locationesque praediorum rusticorum tolli placebat. Nam neque sine publicano exerceri posse; et ubi publicanus est, ibi aut jus publicum vanum aut libertatem sociis nullam esse; Ne ipsos quidem Macedonas idem exercere posse.* (Livy Hist. *lib.* xlv., *c.* 18.) Aemilius Paullus in his oration, says: *Metalla quoque auri atque argenti non exerceri; ferri et aeris permitti.* (*ib. c.* 29).

Plutarch tells us that there were in his time throughout Spain and elsewhere, gold and silver mines still left in the hands of private individuals, which had made those who possessed them as rich as Crassus had become by his famous silver mines

However, the mines of all kinds which, in the time of the Republic, were left in the hands of private enterprise, were by the more powerful Emperors seized, in part to swell the public revenue, and in part to replenish the imperial purse (*ratio patrimonii*).[1] Hence Suetonius says in his life of Tiberius: *Plurimis etiam civitatibus et privatis veteres immunitates et jus metallorum ac vectigalium adempta* (ch. xlix.); and Tacitus in the sixth book of his Annals, ch. xix., speaks of the gold mines of S. Marius, the richest man in Spain, as thus appropriated by the Emperor; *aurarias ejus, quamquam publicarentur, sibimet Tiberius seposuit.* Thus as time went on, almost all the rich and large mines fell into the hands of the head of the Roman State.[2] Amongst the Imperial possessions must, therefore, be numbered the gold mines in Dalmatia, the silver mines in Pannonia and in Dalmatia, the gold mines in Dacia, as well as the tin and lead, not to speak of the gold and silver mines in Britain.[3] To these may be added the iron mines in Noricum, in Pannonia, and in Gallia Lugdunensis, and the famous copper mines in Cyprus and those of Baetica in Spain.

[1] In the *Notitia* for the Eastern Empire (ch. xii.) we read of a *Comes Metallorum per Illyricum.* From the Theodosian Code (x, 19, 5), it would appear that the *Comes Metallorum* was the official who, on the part of the Prince, exacted the proper proportion of gold found in the mines. The decree is of Valentinian and Valens, and is dated A.D. 365. According to Mommsen and Hübner, the *Procurator Metallorum*, as the representative of his Imperial master, was the supreme magistrate of the *vicus* or *pagus*, in which was the mine over which he presided. Thus in the Berlin Corpus (v. ii, *n.* 1179, 956), we read in inscriptions of a Procurator of the copper mines of Sierra Morena, and another at the gold mines near the present Rio Tinto, which were worked by him for the exclusive profit of the Emperor.

[2] Thus in the Digest (48, 19, 38) we read of *Metallum principis* and (48, 13, 6, §2) of *Metalla Caesariana.*

[3] *Fert Britannia aurum et argentum et alia metalla, pretium victoriae* (Tacitus Agricola, ch. xii). Many of the Roman mines in Britain were open quarry-like workings, such as the great open trenches to be seen, one after another, furrowing the sides of the Shropshire hills. Pliny tells us there was a law in his time prohibiting more than a limited production of lead in Britain, so easily and so abundantly was it found in that island. *Nigro plumbo ad fistulas laminasque utimur, laboriosius in Hispania eruto, totasque per Gallias; sed in Britannia summo terrae corio adeo large, ut lex ultro dicatur, ne plus certo modo fiat* (N.H. xxxiv. 49). Cæsar, who had time to make but a very imperfect observation of the products of the country, says of Britain, *Nascitur ibi plumbum album in mediterraneis regionibus, in maritimis ferrum, sed ejus exigua est copia* (B.G. v., 12).

There is a curious account given us by Diodorus Siculus [1] of the way in which mining operations were conducted nearly two thousand years ago. I will quote from a translation made by Booth in 1700. "The manner of working in these mines, and ordering the metal among the Iberians is thus : There being extraordinary rich mines in this country of gold, as well as of silver and brass, the labourers in the brass take a fourth part of the pure brass dug up to their own use, and the common labourers in silver have an Euboick talent for their labour in three days' time ; for the whole soil is full of shining and solid ore, so that both the nature of the ground and the industry of the workmen is admirable. But after that Iberia came into the hands of the Romans, they brought a great number of slaves and delivered them to the task-masters and overseers of the mines. These slaves opened the mouths of the mines in many places, where, digging deep into the ground, are found many clods of earth, full of gold and silver ; and in sinking both in length and depth, they carry on their works in undermining the earth many furlongs' distance, the workmen every way here and there making galleries underground and bringing up all the massy pieces of ore (whence the profits and gains to be had) ; even out of the deepest bowels of the earth."

" There is a great difference between these mines and those of Attica ; for besides the labour, they that search there are at great cost and charge, and besides are often frustrated of their hopes ; and sometimes lose what they had found, so that they seem to be unfortunate to a proverb. But those in Iberia, that deal in mines, according to their expectations, are greatly enriched by their labours ; for they succeed at their very first sinking, and afterwards by reason of the extraordinary richness of the soil, they find more and more resplendent veins of ore, full of gold and silver ; for the whole soil round about is interlaced on every hand with the metals ; sometimes at a great depth they meet with rivers underground, but by art give a check to the violence of their current ; for by cutting of trenches underground, and being sure to gain what they aim at, when they have begun, they never leave till they have finished it ; and to admiration they pump out their

[1] Bk. iii., § 12,–14.

floods of water with those instruments called Aegyptian pumps, invented by Archimedes the Syracusan, when he was in Egypt. By these, with constant pumping by turns, they throw up the water to the mouth of the pit, and by this means drain the mine dry, and make the place fit for their work. For this engine is so ingeniously contrived that a vast quantity of water is strangely, with little labour cast up, and the whole is thrown up from the very bottom to the surface of the earth " (p. 191-2).

It is a strange coincidence that there may be now seen standing in one of those ancient mines described by Diodorus Siculus, a Roman water-wheel, with little tags of rope still hanging to its outer ridge, showing where the slaves stood day and night keeping that wheel in motion by the labour of their brawny arms. In the *Archæologia Aeliana*[1] will be found an illustration given by Mr. Stevenson, of the Roman water-wheel he found in the ancient mines of Tharsis, situated about thirty miles from the town of Huelva, in Spain. The sight of this wheel, dating from the age of Nero, carries us back to that harrowing picture of the sufferings of those thousands of slaves, who, under the kings of Egypt, were forced by cruel taskmasters to work unceasingly in the Egyptian gold mines until they dropped down dead through sheer exhaustion.[2] The workmen's tools still found in ancient Roman mines—the miner's pick, the pick-axe, the hammer and wedges—carry back the mind to primitive, but laborious toil, when the long galleries, many stadia in length, resounded to the monotonous tramp of men, women, and children carrying the heavy ore upon their heads or shoulders to the furnace.

In two places of his Gallic War, Cæsar mentions the trouble given his soldiers by the fact that his barbarian antagonists had recourse to mining operations in order to defeat his advances. The expertness of the Aquitanians in the art of mining he attributes to their familiarity with

[1] Vol. vii, p. 280.

[2] We are here reminded of the thousands of Christians who, in the ages of persecution, were condemned to work in the Roman mines. In Ruinart's *Acts of the Martyrs* and in Eusebius's *Ecclesiastical History* we read of many facts that recall the description of Diodorus Siculus. An official named therein is *Praepositus Metallorum*, probably an overseer or taskmaster. In the Roman Digest, under Justinian, we read : *Proxima morti pœna metalli coercitio* (xlviii, 19, 28). See De Rossi, *Bulletino di Arch. crist.* for 1868, p. 17, &c.

their native copper mines, while the Gauls, he said, were rendered excellent miners by their large iron works.[1]

The British chieftain Galgacus, haranguing his countrymen before the battle of the Grampians, puts well before them the hard service they would have to undergo in their native mines, if victory did not favour their cause : *ibi tributa et metalla et ceterae servientium pœnae; quas in aeternum perferre, aut statim ulcisci, in hoc campo est* (Tac. Agric. *c.* xxxii). He had said before what they had lost : *neque enim arva nobis, aut metalla, aut portus sunt, quibus exercendis reservemur* (*ib.* xxxi).

In the ancient copper mines of Asturias have been found bronze axes (*dolabra*), stone and iron hammers (*mallei*), 'gads' or wedges (*cunei*), pincers (*forcipes*), lamps in baked earth, and bronze hearths or braziers.

Owing to the great quantity of fuel required for smelting purposes, the Roman mining operations could be conducted only in the neighbourhood of great forests, whence they could be abundantly supplied. The vast heaps of scoriae still to be found in the forests of Dean and Sussex, in which Roman coins of the period are found, are evidence of this fact. Owing to the imperfect smelting of those times, great quantities of ore had to be used. Hence to save transport, the furnaces were placed as near the mouth of the mine as possible. So rich in ore are the remains around the ancient mines, that it has often invited the enterprise of modern speculators to put them through the process of re-smelting by the more searching methods of the present day.[2]

In many instances it would seem that furnaces were

[1] *Illi alias eruptione tentata, alias cuniculis ad aggerem vineasque actis, cujus rei sunt longe peritissimi Aquitani, propterea quod multis locis apud eos aerariae structurae sunt* (lib. iii., c. 21). Speaking of the arts used by the Gauls in the defence of Bourges, he says, *Aggerem cuniculis subtrahebant, eo scientius quod apud eos magnae sunt ferrariae, atque omne genus cuniculorum notum atque usitatum est* (*lib.* vii, *c.* 22). The use of ventilation shafts in mines was known to both the Greeks and Romans. Pliny says of the Aquitanians : That those who are employed in the work of pumping up water out of the mines, are on their feet day and night. *Aquitani stantes diebus noctibusque egerunt aquas lucernarum mensura, amnemque faciunt* (H.N. xxxiii, 31).

[2] Where fuel was scarce, Pliny relates how the copper-workers of his day used to add eight parts of lead to a hundred of copper ore, and how the Gauls used to melt the mineral ore between red-hot stones. It is supposed, from discoveries made, that the ancient Britons had a process of boiling water, by throwing into it stones made red-hot in fires kindled outside their huts. *Octonas plumbi libras addunt, et bene recoquunt propter inopiam ligni. Quantum ea res differentiae afferat, in Gallia maxime sentitur, ubi inter lapides candefactos funditur* (H.N. xxxiv., 20).

placed on lofty hills, in order that the wind might fan the flame, a contrivance practised by the Peruvians when first visited by the Spaniards. In his *Roman Wall*,[1] Dr. Collingwood Bruce gives a very interesting description of a draught sought from nature for some furnaces near Lanchester : " Two tunnels were 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."

That the art of smelting was still very imperfect at the time of Strabo, or at the close of the first century before Christ, may be judged from the fact that no profit was to be gained by extracting silver ore from lead, in which it was present in small proportions. It is in speaking of the Spanish mines that this author makes the observation[2] that in furnaces for smelting silver the chimney is generally higher than that for gold, in order, he says, that the deleterious vapours may be carried away without hurting the workmen.

In his learned disquisition on the silver mines of Laurium, which played so important a part in the fortunes of Athens, Boeckh says : " that the Athenians made use of the bellows and of charcoal is not improbable."[3] Now it has been observed that when at a later period furnaces were set in valleys, (they were generally placed near some stream to carry off the product), and bellows were then used, by means of which a higher and more equable temperature was brought to bear upon the fire, the scoriae of this epoch are poor and more like those of modern times.[4]

On the walls of the Catacombs of Thebes very valuable

[1] P. 432, ed. 1852.

[2] Bk. iii., ch. ii., sec. 8 *in fine*.

[3] Public Economy of Athens, vol. ii., p. 433.

[4] Leger, *Travaux publics des Romains*, p. 725. It has been supposed from the position of certain ancient tanks, discovered near Roman smelting furnaces in the forests of Dean and of Sussex, that when mere 'air-bloomeries' gave place to 'blast-bloomeries,' the bellows in these latter were moved by water-power, either natural as of streams, or artificial as of reservoirs.

drawings have been discovered, representing the ancient Egyptian mode of metal working. We see there frequently reproduced under the same type furnaces of very high temperature for melting glass, and for baking objects of the ceramic art. As figured in a modern French work, we see a cylinder or stove-like erection about the height of a man raised over a hearth, on which the fire is fanned through apertures in the tube or stove, the flame darting up the chimney and appearing at the top.[1] The splendid passage of Homer, where Hephaestos, the Grecian Vulcan, gathers together the materials for Achilles' shield, represents him placing them in a furnace, upon which straightway the bellows begin to blow from twenty mouths.[2]

In the excavations made by Hon. W. O. Stanley in Anglesey, an object was discovered which was, on examination, pronounced by Professor Ramsay to be the vitrified nozzle of a bellows used for smelting purposes by the ancient Britains on that very spot where remains of smelting-hearths and mining instruments are still discovered.[3]

Perhaps a description of the method of smelting in use throughout the whole of India in very early times, may throw some light on the contrivances used by our forefathers on many a site where they can be proved to have worked the metals to be found in our rich and fertile island. "The furnace or bloomery in which the ore is smelted is from four to five feet high; it is somewhat pear-shaped, being about five feet wide at bottom and one foot at top. It is built entirely of clay. There is an opening in front about a foot or more in height, which is built up with clay at the commencement and broken down at the end of each smelting operation. The bellows are usually made of a goat's skin. The bamboo nozzles of the bellows are inserted into tubes of clay, which pass into the

[1] *Ib.* Plate viii, fig. 26

[2] How common the use of the bellows was in the time of Augustus, appears from the following quotations :—

Virgil, *Georg.* iv., 170-2,

*Ac veluti lentis Cyclopes fulmina massis*
*Quum properant, alii taurinis follibus auras*
*Accipiunt reddunt que,*

And *Aeneid*, viii., 449-450,

*Alii ventosis follibus auras*
*Accipiunt reddunt que.*

Horace, *Sat.* i, 4, *v.* 19-20,

*At tu conclusas hircinis follibus auras*
*Usque laborantes, dum ferrum molliat ignis.* Cf. Persius, *Sat.* v., *v.* 10-11, and Juvenal, *Sat.* vii., *v.* 111.

[3] Vide figures on Plate iv. of the article, *Arch. Jour.*, xxvii, or p. 6 and 11 of the reprint.

furnace. The furnace is filled with charcoal, and a lighted coal being introduced before the nozzle, the fire in the interior is soon kindled. As soon as this is accomplished, a small portion of the ore, previously moistened with water to prevent it from running through the charcoal, but without any flux whatever, is laid on the top of the coals and covered with charcoal to fill up the furnace. In this manner ore and fuel are supplied, and the bellows are urged for three or four hours. When the process is stopped, and the temporary wall in front broken down, the bloom is removed with a pair of tongs from the bottom of the furnace."[1]

In his *Crania Britannica*[2] Dr. Thurnam, speaking of the way in which the ancient Britons smelted tin, says : "The ore, separated by washing, must have been mixed with fuel, and burnt on an open hearth or in a simple furnace, constructed of a few stones sunk a little in the ground,—a primitive bloomery,—differing little from such as until a late period were the only furnaces for the lead and iron furnaces of Derbyshire. As tin melts at 446°, no great draught of air, natural or by some primitive form of bellows, would be required to reduce it to the metallic state ; in which form the merchants purchased it and carried it into Gaul."

Roman smelting furnaces have been found all over the empire, in Britain, near Almeria in Granada, which was the Portus Magnus of the Romans for their traffic with Italy and the East, in Italy and in Greece. Their type was very simple and very small, and those found in Attica, Spain, England, and Tuscany, whether for the extraction of lead, copper, iron, or tin, differ from those of modern times in little save size. De la Sauvagère gives sketches of a series of brick ovens of Roman origin found in some excavations near Marsal. They were for smelting copper, and present perhaps the first application of reverberatory ovens, in which the hearth and the laboratory are still unseparated.[3]

How far coal was used by the ancients for the purpose of smelting cannot be very well determined. Dr. Bruce says : "There is no doubt that the Romans made use of

[1] Ure's Dictionary of Arts and Manufactures, art. *Steel.*

[2] P. 101.

[3] *Vide* Leger, Plate viii, N. 23-5.

the mineral coal where beds of it were found in their vicinity."[1] Coals have been found in the Roman station of Housesteads, and a cart-load of unburnt coals was unearthed amongst the Roman remains at Risingham, while coal ashes were found at Walton House station and at Carvoran.[2] Indeed, "in nearly all the stations of the line," says Dr. Bruce, "the ashes of mineral fuel have been found, and in some a store of unconsumed coal." Some twenty bronze celts, which had apparently been attached to straight wooden handles, have been found in a Roman coal-mine in Andalusia,[3] and the Romans undoubtedly came across coal in France, when cutting for their aqueducts near Rive-de-Gier and Frejus. The most extensive Roman coal-mine in Britain mentioned by Dr. Bruce was near Sewingshields, at Grindon Lough. That the ancient Greeks were acquainted with stone coal is evident from the words of Theophrastus, an author who lived three hundred years before Christ (*de Lapidibus*, N. 16): *οὓς δὲ καλοῦσιν εὐθὺς ἄνθρακας τῶν ὀρυττομένων διὰ τὴν χρείαν εἰσὶ γεώδεις, ἐκκαίονται δὲ καὶ πυροῦνται καθάπερ οἱ ἄνθρακες . . . οἷς καὶ οἱ χαλκεῖς χρῶνται.* "The coal commonly so-called, which is dug out of the earth for man's use, is of an earthy (or stoney) nature; it is kindled and burnt like coal (charcoal). Of this (stone) coal, workers in iron make use." Solinus has also been quoted for the use of stone-coal amongst the Greeks, and if the red-hot stones which, according to Pliny, were used by the Gauls for smelting copper, were nothing more than stone-coal, their efficacy would perhaps be rendered more intelligible to modern men of science.

In May 1876 there was discovered in some copper mines, which seem to date from pre-Roman times, at the village of Aljustrel, situated in Southern Portugal, between Ourique and Messejaman, a long Latin inscription, which seems to bring all at once the everyday work of a Roman mine before our eyes.[4] The text is engraved on both

[1] *Roman Wall*, p. 118. Mr. Wright says coal has been abundantly found among the fire-places of the hypocausts of the Roman Uriconium, at Wroxeter, in Shropshire (*Celt, Roman, and Saxon*, p. 290).

[2] *ib.* pp. 183, 330.

[3] Mr. Yates in *Proceedings of the Somersetshire Arch. Soc.*, vol. viii, p. 27.

[4] This inscription, which is on a bronze tablet, eight to thirteen millimetres thick, seventy-two centimetres high, and forty-three broad, has been engraved and illustrated by Senhor Augusto Soromenho Pereira, in *La Table de bronze*, Lisbon, 1876, from which I take this description. It was

sides of a bronze tablet, some three feet long by two in width. The two inscriptions are not, however, different, but one and the same, (excepting some slight variations,) which is engraved on each side of the tablet. Though, however, the bronze has suffered some mutilation, by which several letters are wanting in every line of the right hand side of the obverse, and on the left of the reverse, and it is furthermore broken at one end, still owing to the happy circumstance that the lines on one side contain more words than those on the other, so that there are several more lines on the reverse than there are on the opposite side; the lines never begin on one side with the same words as on the other. Thus, in spite of mutilation, this accidental circumstance has preserved a pretty full copy of the whole inscription, though not of the whole law.

To judge from the style, and from the character of the letters, this inscription must belong to the first century, and may be set down to the time between Vespasian and Domitian. On the left of the front of the tablet under the word CONDUCTORI may be seen the numeral III, from which we may conclude that the law styled *locationis conductionis*, or the regulations to be observed within the territory belonging to the mines of this district, was engraved on various tablets, of which this is the third. The district of a mine comprised all the population thereabouts, for whatever purpose there settled. The *territorium Carthagenæ* in Spain, an instance in point, was twelve leagues in circumference.

The *metalla* here described as situated in the *vicus* or *villa Vipascensis*, under the *conventus juridicus Pacensis*, were fiscal, that is to say, belonging to the state, and yielded silver, copper, slate, sand or perhaps clay. All living in the neighbourhood were under the jurisdiction of the *Procurator metallorum*. The products of such mines as he was himself unable to attend to, he was empowered to let out to others, whether individuals, towns or companies. The chief stipulation or basis of concession was, that in the regulation of the mines the authority of the Procurator was henceforth to be replaced (barring some

discovered by the Company *de minération transtagante* which had undertaken to work anew these ancient copper mines.

exceptions) by that of the contractor (*conductor*). The inscription which has thus come to light is one of the subordinate regulations. It is a *locatio-conductio vectigalium, rerum operarum et operis.* The *conductor* on the one hand received the *centesima auctionum*, the *capitularium* on the sale of cattle and slaves, the *scriptura* of those who worked the σκωρία (*scaurarii*), and of the potters (*testarii*), and the fines for contraventions. On the other hand he had the management of the public bath, and received the payment made by the bathers; but it was enjoined him under severe penalties to have the bath always in readiness, and to provide all requisites at his own expense. At the expiry of his office (*conductione peracta*) he was bound to leave the building in the same state as he received it, save as regards the damage caused in course of time by the effects of the weather.

In the instance of these mines the farming of the state revenues was made over to a company, for the *conductor* had a *socius* and an *actor*, *sive syndacus per quem, quod cum minutis agi fierique oporteat, agatur, fiat.* As we learn from Pliny, other mines in Spain, as the tin mines of Sisapo, the *metallum Santarense* and the *Antonianum*, both in Andalusia, were in his day all worked by commercial companies, which rented them at fixed sums levied by the revenue officers. These *conductores* or private contractors who held mines under an Imperial Procurator must not be confounded with the *Publicani* who farmed mines under the *Censores.* The *Publicani* (properly so called) were only collectors of revenue; the *conductores* were agents who themselves administered and worked the mines. Thus the contract for the Vipascan mine comprised the letting of the bath, of the mines, of trades, of purveying the necessaries of life, with the power of sub-letting, as the tablet distinctly says.

It may give some idea of the variety of things provided for the government of this mining district by this regulation, emanating from the Emperor, to whom the supreme dominion of the mine belonged, if I set down the divisions of the law which have remained to us. They are arranged in the following order:—

1. *Centesimæ argentariæ stipulationis*—one per cent. levied on all sales.

2. *Scripturæ præconii*—the one or two per cent. or poll tax paid to the public crier at all sales by auction.
3. *Balinei fruendi*—on the use of the public baths.
4. *Sutrini*, of shoemakers—no one can mend shoes except by renting the trade from the contractor.
5. *Tonstrini*, of barbers—no one can shave another, except servants their masters, except by renting the office from the contractor.
6. *Tabernarum fulloniarum*—fullers' booths—no one can clean garments except by paying a rent to the contractor.
7. *Scripturæ scaurariorum et testariorum*—on the sums to be paid by those who wish to break, sort, or wash silver and copper ore within the district.
8. *Ludi magistri*, or schoolmasters—they are freed from all taxes.
9. *Usurpationis puteorum sive pittaciarum*—those who by means of a notice affixed thereto appropriated pits of mineral had to pay so much for each man employed in the work.

The rubric concerning the public schoolmaster has given De Vit[1] a clue to the farther settlement of the date of this inscription. It is here provided that a schoolmaster for the children of this mining population shall be paid a salary from the public treasury. Now we know from Suetonius,[2] that the Emperor Vespasian was the first to establish a public stipend for the Latin and Greek teachers of rhetoric, while before that time there were none but private masters. This decree was issued, it is supposed, A.D. 74. But, as S. Jerome testifies in his chronicle, Quintilian was the first to receive a state salary for teaching, A.D. 88. This rhetorician, however, had been brought to Rome by Galba, A.D. 68. As in the provinces, therefore, this law will have been carried out some time after it was put in force in the capital of the Empire, the regulations under consideration may with great

[1] *Opere varie*, vol. vi., p. 418.

[2] *Ingenia et artes maxime fovit: primus e fisco latinis graecisque rhetoribus annua centena constituit: praestantes poetas, nec non et artifices, Coae Veneris, item Colossi refectorem, insigni Congiario magnaque mercede donavit* (Suet. *Vita Vespasiani*, c. 18).

probability be attributed to Domitian, about the end of the first century.

Not the least interesting fact connected with the accidental discovery in modern times of this record of bygone days, is the bringing to our knowledge of some Latin terms hitherto unknown to us, which have now, therefore, to be inserted in our dictionaries. Such words are *lausiæ*, *pittaciarium*, *recisamen*, *rutramen*, *scaurarius*, *testarius*, *ubertumbus* and *ostilis*. All these words have been more or less diffusely discussed and interpreted,[1] with the exception of *ubertumbus* and *ostilis*. The former of these two words has not as yet been properly deciphered; the latter has been the occasion of much conjecture, and as it is connected with the matter of fuel supplied to a Roman furnace, may form a fitting conclusion to the present disquisition.

The word *ostilis* occurs under the rubric *Balinei fruendi*, in the twenty-ninth line on the front of the tablet, and in the twentieth line of the back, and can be very clearly read on both sides. The passage in which it occurs, is as follows :—

CONDUCTORI VE*NDERE LIGNA*[2] NISI EX RECISAMINIBUS RAMORUM QUAE OSTILI IDONEA NON ERUNT NE LICETO.

In these two lines we have two words hitherto unknown, *recisamen* and *ostilis*. The learned editor of the new Italian edition of Forcellini's Latin Dictionary, Professor De Vit, suggests the following as the only plausible reading : "The contractor is forbidden to sell wood, except such pieces of the branches of trees which shall not be suitable for making spears at some future time."

It must be borne in mind that the contractor is bound to have at all times a store of wood for the heating of the public bath, sufficient to last for a given number of days, probably thirty. If he sells any wood fit for the military purpose mentioned above, or any wood except small fuel, the contractor will be liable to a heavy fine, *viz.*, for every cart-load thus taken away, 100 sesterces.

We must observe that *ostilis* is here considered equiva-

[1] See the *Ephemeris Epigraphica*, vol. iii, fasc. 3, Romæ, 1877.

[2] The words in italics are defaced in the original, but are admitted on all hands as the most evident reading.

lent to *astilis* or *hastilis*.[1] The absence of the aspirate creates no difficulty, and Varro himself says *asta* is so called *quod astans ferri solet*.[2] As for the *o* instead of an *a* there are many instances given by De Vit, as where *vocatio* stands for *vacatio*, *vocua* for *vacua*, *vocivae* for *vacivae*, *voleo* for *valeo*, etc., etc.

That special provision should be made to keep the vast and scattered Roman army well provided with wood for spears and javelins, is not extraordinary. The spears used by the different divisions of the Imperial forces varied greatly in form, but their number must have been very considerable. The Caesarian javelin or *pilum* was nearly seven feet in length, the iron head and the wooden shaft being each four and a half feet or three cubits long, the former extending half-way down the shaft. But besides the javelin carried by the Roman *hastati* and *principes*, we find in vase-painting that there were other spears from only two to three feet long, made not for thrusting with, but for throwing. In these latter the iron part is equal to one third of the entire length.

Polybius says, that each soldier of the three great divisions of a Roman legion carried two long javelins, which gave the name *pilani* to the division of the Roman army by which they were used. The first line of the Roman legion, called the *Hastati*, consisting of youths in the first bloom of manhood, had for their offensive weapons, a sword and a heavy javelin; but one-third of their number were more lightly armed with a spear (*hasta*), and a light javelin (*gaesa*).

This first line of *Hastati*, and the second line of *Principes* (men in the full vigour of life), amounting together in each legion to thirty maniples, each composed of sixty privates, formed what were called the *Antepilani*.[3] Next came the *Triarii*, or veterans, who, in their triple ranks, equal altogether at one time to each of the two former

[1] Hübner thinks *ostilis* stands for *ustilis*, and may be derived from *urere*, to burn (Ephem. Epigraph., l. c. p. 176, and *C.I.L.*, vol. iii, p. 163—186.) Herr Flach derives the word from *ostilum*, a mediæval Latin term, whence is derived the modern French *outil*, a tool or instrument.

[2] 5, LL., 54 § 115, Cf. Isidore, 18 Orig. vii, 1, Nomen autem *hasta* ab *astu* sumpsit, unde et *astutia*, cf. other instances of the absence of the *h* in Orelli, *n.* 3452, and in Henzen's Supp. *ib. n.* 76747.

[3] Vide Smith's *Dict. of Antiquities*, and Guhl and Koner's *Life of the Greeks and Romans*, p. 241-2.

divisions of the Roman legion, were armed also with the javelin, and were hence called simply *Pilani*.

Of the *Peltastai* in Xenophon's army we read that they carried five shorter and one longer javelin. So the rest of the Roman legion, besides bows, slings and swords, carried each seven javelins[1] or spears with slender points, like arrows, so that when thrown they bent and could not be easily returned by the enemy.

As for the auxiliary forces of the Roman empire they were, it is supposed, armed in the same way as the regular troops. That the Roman cavalry made use of the javelin, appears from the book written by Pliny *De Jaculatione Equestri*.[2]

The necessity for such enormous numbers of javelins and spears would naturally call for forethought on the part of governors scattered throughout the Provinces, and for measures that would provide a sufficient supply for regular armaments and for every emergency. Hence it is not surprising to read in the work of Vegetius on Military Affairs, that besides quantities of bitumen, sulphur, liquid pitch and incendiary oils, a sufficient quantity of wood must be laid up amongst the military stores, which the Roman soldiers, no doubt, during the long winter hours of forced inactivity, would have time to fashion into shape before the next campaign began. "The magazines," he says, "must be stored with iron, steel and coals, to make arms, *together with wood proper for spears*."[3]

The injunction then that the bath-keeper in a Portuguese mining district, during the reign of Domitian, should, in sorting his wood, have an eye to such pieces of timber as were of the proper length, strength and shape, to serve as shafts for spears in the never ceasing wars of that period, seems in itself far from improbable, though chance alone has, as in many other instances, but recently brought this particularity of a distant provincial's work-a-day life to our knowledge. If any confirmation were needed, it might be sought for in the Geography of Strabo, who tells us that in the region inhabited by the Salassi in

[1] Ennius says of these latter *Rorarii*, if not of the *Hastati* proper
*Hastati sparygunt hastas, fit ferreus imber.*

[2] *Sed et nos diximus in libro de jaculatione equestri condito.* (N.H., *l.* viii. *c.* 65, § 3)

[3] Bk. iv. ch. 8.

northern Italy, there were some gold mines, which had from ancient times been worked by themselves for their own profit. They too had fuel to provide for the smelting furnaces, and had spears to make for their warfaring days out of the wood thus brought to their doors. When, then, the Roman general Valerius Messala came to pass the winter amongst them, it is recorded that he bought from these hardy and turbulent mountaineers not only wood for firing, but also wood to serve for spears, and for the gymnastic exercises of his soldiers.

Μεσσάλας δὲ πλησίον αὐτῶν (Σαλασσῶν) χειμαδεύων τιμὴν ξύλων κατεβαλε τῶν τε καυσίμων καὶ τῶν πτελείνων ἀκοντισμάτων καὶ τῶν γυμναστικῶν (*l.* iv., *c.* vi, §7).[1]

The gold mines in the hands of the Salassi were seized by the Consul Appius Claudius Pulcher in the year of Rome, 615. It may have been on this occasion that the Senate made a decree against these mines, as is mentioned by Pliny.

It may be useful, in conclusion, to gather into a few sentences a summary of what has been said on the subject of ancient mines, upon which we possess no treatise by any ancient author, nor any article or book in the English language with which I am acquainted, in which the subject is treated in a consecutive manner, with the one exception of Boeckh's Dissertation on the Silver Mines of Laurium.

There are two distinct ways in which State mines were worked by the ancient Romans. Either they were let by the Roman revenue-officers to the Publicani, or they were kept in the hands of the State, and were handed over to a Procurator. In the first case the Publicani themselves undertook to pay the revenue a fixed sum for the mines they farmed, while they themselves exacted such taxes from the owners or workers of those mines as to leave themselves a margin of profit for their trouble. In the second case, the Imperial Procurators either worked the mines themselves at the risk and profit of their masters, or they let them out to companies or individuals, who

[1] *Ipsi quoque Valerio Messalae, dum vicinis locis agebat, non nisi pretio accepto, ligna ad focum, et ad exercitationes ulmea hastilia praebuerunt.* (Freinshemii supplementa in locum, Lib. cxxxi, Liviani).

paid them a certain rent fixed in proportion to the number of men employed in them.

The Procurator, if he worked the mine himself, had under him: (1) a slave who acted as director of the work—*servus proactor procuratoris*; (2) a foreman whose office it was to test and pass the work done (the formula was *probante N. N.*); (3) an engineer who had charge of the mechanical contrivances (*machinator*). If the Procurator let the work of the mine out to others, it was either to a single contractor, or to a company, who before the law had the status of Publicani, and were often given that name. The Publicani, however, properly so-called, were mere tax-collectors; the former were real administrators of the mines.

In either case, however, that is, whether the Procurator himself worked, or whether he let out the mine, he had all the accounts of the commercial enterprise to keep in an office established for that purpose. In it the Procurator had under him a clerk or register-keeper (*commentariensis*), a steward or disbursar (*dispensator*), a collector or caster of accounts (*tabularius*), and a treasurer (*arcarius*).

Officers and soldiers were stationed to guard the mine and keep order amongst the workmen. For this purpose, either a tribune, a centurion, or a decurio was detached from his regular corps, and stationed in the mining district, either in a position of independence, or under the command of the Procurator.

The workmen were either common slaves, hired freemen, soldiers, or convicts and prisoners. During the age of persecution, Christians were sent in thousands to the copper mines of Palestine, and to the various mineral or stone mines in Cilicia, the Thebaid and Cyprus, as after the taking of Jerusalem the captive Jews were in part condemned to work in the mines and quarries of Egypt. These poor prisoners, the confessors of the Faith, were all, like ordinary criminals, on being condemned to the mines, first beaten with rods. While at work, their feet were kept in irons, they had to sleep on the bare ground, they were pinched in food, deprived of the use of the bath, and were almost naked. In the subterranean mines each workman bore a little lamp, fixed to his forehead, to guide his footsteps, and serve as a signal to others, while the

air and stench in these ill-ventilated caverns was so great that the ill-treated labourers often swooned away. Pliny says how in his day these poor creatures were kept hard at work day and night, many of them spending whole months underground without ever seeing the daylight, for the burdens they carried on their backs they handed over to others, so that the last only of the file came near the mouth of the pit.[1]

It may not be uninteresting to conclude with an eloquent passage from one of the letters written by S. Cyprian, the great African Bishop of the third century, in which many of these particulars are set forth. It is inscribed to Nemesianus, Felix, and other seven of his fellow-Bishops, likewise to his fellow-Presbyters and Deacons, and the rest of the brethren in the mines.[2]

"But that, being first grievously beaten and stricken down with clubs, ye, by sufferings of that kind, entered upon the glorious beginnings of your confession, is a thing no wise to be abhorred by us. For a Christian body shrinks not at clubs, whose whole hope is in THE WOOD... .....And what wonder, that, being vessels of gold and silver, ye have been consigned to the mines, that is, the home of gold and silver, except that now the nature of mines is changed, and places which before were wont to yield gold and silver, have begun to receive them. They have also put fetters on your feet, and have bound with shameful bonds the blessed members and the temples of God; as though the spirit also were bound with the body, or your gold could be tainted by the contact of iron..... .....O feet, with fetters and cross-bars impeded for a while, but quickly in a glorious course to speed to Christ! Let envious or malignant cruelty hold you here as long as it will, with its bonds and fetters; soon will ye from earth and from these sufferings come to the Kingdom of Heaven. In mines the body is not cherished by couch and pillows; but cherished it is by the refreshment and consolation of Christ. On the ground lieth the toil-worn frame, but no punishment it is to lie down with Christ. Squalid, unbathed, are the limbs disfigured with filth and foulness; but that is spiritually cleansed within, which without is in

[1] N. H. xxxiii. 21.

[2] Epistle lxxvi, Oxford Translation, p. 305.

the flesh defiled. Scanty is bread there; yet *not by bread alone doth man live, but by the word of God.* Shivering, ye have no clothing; but whoso is *clad with Christ* is abundantly clothed and adorned. Rough is the hair of your half-shorn heads [whereby they were marked as slaves]; but since *the head of the man is Christ*, any thing must needs become that head, which is illustrious for the Name of Christ. All this deformity, detestable and foul in the eyes of the Gentiles, with what splendour will it be recompensed! This brief suffering in time, for what a reward will it be exchanged of bright and eternal glory, when according to the saying of the blessed Apostle, *the Lord shall change our vile body, that it may be fashioned like unto His glorious body!*"