

and the Koran. Such arts might not easily have been imposed upon a native Egyptian, but a barbarous foreigner like the Pharaoh of the Hyksos, might easily have been duped by the superior skill of "wise men" instructed in the knowledge and arts of the Egyptians. When the descendants of Timúr established their empire at Delhi, they were similarly dazzled by the tricks of the Hindú conjurors. The Emperor Jehangueir informs us, that even his father, the enlightened Akbar, consulted some of these soothsayers before setting out on an expedition, and found their predictions verified by the event. He also gives us the particulars of an exhibition in his own court by some jugglers from Bengal, which far surpasses that of the Egyptian sorcerers in the court of Pharaoh. The following extracts from the emperor's autobiography, cannot fail to interest the reader.

They (the jugglers) took a small bag, and having first shown that it was entirely empty, one of them put his hand into the bag; on withdrawing his hand again, out came two game cocks of the largest size and great beauty, which immediately assailing each other, fought with such force and fury that their wings emitted fire at every stroke. This continued for the full space of an astronomical hour, when they put an end to the combat by throwing a sheet over the animals. Again they withdrew the sheet, and there appeared a brace of partridges with the most beautiful and brilliant plumage, which immediately began to tune their throats as if there were nothing human present; pecking at worms with the same sort of chuckle as they are heard to use on the hill side. The sheet was now thrown, as in the other instance, over the partridges, and when again withdrawn, instead of those beautiful birds, there appeared two frightful black snakes with flat heads and crimson bellies, which with open mouth and head erect, and coiled together, attacked each other with the greatest fury, and so continued to do, until, as it appeared, they became quite exhausted, when they fell asunder. The sheet was thrown over as before, and when finally withdrawn, there appeared not a vestige of the snakes nor of anything else.

One of the seven men stood up before me (says the emperor,) and setting open his mouth, out came the head of a snake. Another of the men seized the snake and drew it out by the neck to the length of four cubits. This being disposed of by casting it to the ground, another followed in the same manner, and so on to the number of eight, none of them being less than four or five cubits in length. These being all cast loose upon the ground, were immediately seen writhing in the folds of each other, and tearing one another with the greatest fury; a spectacle not less strange than frightful.

It would be no difficult matter to collect numerous anecdotes of the wonders performed by the conjurors and snake-charmers of the East; some of which even now puzzle enlightened Europeans, and consequently may well have deceived such a prince as the fourth Pharaoh. But the miracle wrought by Moses was uncontrovertibly proved to be supernatural, for Aaron's rod swallowed up the rods of the magicians.

Untaught by this unequivocal manifestation of the Divine power, the wicked ruler of Egypt refused to let the Israelites depart, and the first plague was inflicted both as a chastisement and a warning:—

And Moses and Aaron did so, as the Lord commanded; and he lifted up the rod, and smote the waters that were in the river, in the sight of Pharaoh and in the sight of his servants; and all the waters that were in the river were turned to blood. And the fish that was in the river died; and the river stank, and the Egyptians could not drink of the water of the river; and there was blood throughout all the land of Egypt. (Exod. vii. 20, 21.)

The most striking monument of the severity of this plague is the river itself. From the earliest ages the Nile has been the great source of support to the inhabitants of Egypt; by its overflowings the land is fertilized; in every season its bed is nearly full, and its inundations occur at the period of the year when the heat of a scorching sun has dried up

all other streams. In most lands, the overflowing of a river is the signal of wide-spreading calamity, and diffuses universal consternation; the overflowing of the Nile, on the contrary, is the announcement of fertility to all who dwell upon its banks; the rising of the waters is hailed by benedictions, thanksgivings, and songs of triumph; even the slave bowed down by toil, and the Fellah sinking under oppression, share the general joy, and for a day forget the cruelties of man in contemplating the bounties of nature. The ancient Egyptians ascribed a divine origin to the river, believing it an emanation from Knouph, or Cneph, whom they regarded as the father of the gods; and on one of the monuments, that deity is depicted pouring forth water from a vase, as a type of the inundations which were to fertilize the land. Even at the present day, many of the native Egyptians, both Christian and Mohammedan, believe that the Nile flows from the terrestrial paradise, while others think that it is a copy of a celestial Nile which flows through the mansions of the blessed.

The waters of the river are supposed to be peculiarly wholesome and sweet; indeed, the Turks frequently stimulate themselves to artificial thirst by eating salt, in order that they may drink the more of this delicious beverage. All travellers, ancient and modern, unite in praising the water; it is even asserted by some, that it has valuable medicinal qualities, and that the cattle which drink of it become more fat and more fruitful than those fed on the banks of any other river. A river so justly valued and even revered as a divinity, was now rendered an object of disgust and abhorrence; it is therefore impossible to conceive a miracle more striking or more likely to effect the purpose for which it was designed.

## ON WRITING MATERIALS.

### No. III.

#### THE HISTORY OF A BLACK-LEAD PENCIL.

THERE are probably but few of our readers who imagine, while using a black-lead pencil, that that useful little instrument is, and long has been, a source of much wealth to some of our countrymen. Such, however, is the case; for nearly three hundred years, the black lead (the essential part of a black-lead pencil,) has been derived from our own mineral treasures in a state of greater purity, and in more abundant supply than in any other part of the world. It is a remarkable circumstance in the mineralogical history of our globe, that almost every substance which is useful to man, appears to have some particular locale in which it is found more abundantly than at any other spot. This locality, therefore, becomes the mart from which other nations are supplied; until at length, a new deposit, or a new mine, is discovered in another place, and draws away, and often with ruinous effect, the traffic from the before-favoured spot. Black lead, for instance, has been found in many parts of the world, in a state of greater or less purity; but when the celebrated Borrowdale mine\*, in Cumberland, was discovered, the others shrunk into insignificance, and the "crayons d'Angleterre" have become the standard of excellence all over the Continent. It has lately been stated in an American scientific work, that a black-lead mine was worked in Massachusetts by the French residents about a century ago; but it was long abandoned, and has only recently been prosecuted, but with such success that it promises to yield a very abundant supply.

\* See *Saturday Magazine*, Vol. I., p. 24.

In order to give a tolerably complete history of a black-lead pencil, we will first describe the materials used, and then the process of manufacture. In the first place we must state, that black-lead pencil is altogether a misnomer, there being not a particle of lead in the manufacture. The marking material is plumbago, or graphite, a compound of carbon and iron, in the proportion of nine parts of carbon to one of iron. This mineral is of a dark iron-black colour, passing into steel gray. It occurs in a massy form, in kidney-shaped lumps, varying from the size of a pea to much larger lumps, and is found in beds of quartz, and in masses of calcareous earth. It has a glistening metallic lustre, and the fracture presents a texture somewhat between scaly and granular. The large masses are slaty in their appearance, and occur generally in distinct concretions. It takes a considerable polish by rubbing, and, as is well known, gives a dark lead-gray streak when drawn along paper or wood. It is unctuous to the feel and not very brittle, and about twice as heavy as its own bulk of water. The large quantity of carbon which it contains, renders it peculiarly fitted to the purposes of the chemist, in the form of crucibles, as it will bear an intense heat. The other purposes to which it is applied, are to relieve friction in the axes and pivots of wheels. Its power this way may be illustrated by rubbing a button first on a plain board, five or six times, and applying it to a bit of phosphorus, the latter will immediately burn. When rubbed on a surface covered with plumbago, double or treble the friction will be required to produce the same effect. Plumbago is also used to give a polish to shot and gunpowder, to give a preservative coating to cast iron, and to mix with clay to form a lining for furnaces. At North Carolina shingles are coated with a mixture of black lead and oil, which is said to be an excellent preservation against fire. For all these latter purposes, however, coarse and impure black lead is employed.

Borrowdale, to which we have alluded, is situated in the heart of the lake district of Cumberland, a district which, for natural scenery and for poetic association, connected with the eminent men who have lived, and still live there, is a favourite spot with English tourists. In the reign of Elizabeth there was a mine of copper and lead in the immediate vicinity, which was worked by some Germans; but on finding some small veins of gold and silver in the mine, a contest arose with the crown as to who should possess the precious metals; Elizabeth gained the contest, and the Germans soon afterwards left the country. About that period, however, the Borrowdale black-lead mine was discovered, and soon drew attention to its valuable contents. Its celebrity gradually increased, and with it an extensive system of purloining. Sometimes the workmen in a neighbouring mine would cut through into the black-lead mine and carry off quantities of the contents. At another time a party of miners overcame a guard placed at the entrance of the mine, and kept possession of the whole place for several days. An Act of Parliament was obtained in the last century, inflicting severe penalties on all depredators, and since then an improved mode of protection has been devised.

The mountain which contains this valuable mine, is situated at a few miles from Keswick, and is about 2000 feet high. The entrance to the mine is about 1000 feet from the level of the ground, from which spot there is an excavated cavity, extending 660 feet horizontally into the body of the mountain; this passage has a railway laid along its whole length, and is used to convey the ore from the bowels of the mountain to the entrance

A few particulars concerning this mine were given by Campbell, in his Political History of Great Britain, about fifty or sixty years ago. He says,—

The mine before mentioned is private property, is opened but once in seven years, and the quantity known to be equal to the consumption in that space sold at once; and as it is used without any preparation, it is more valuable than the ore of any metal found in this island. But there is nothing improbable, and much less impossible, in supposing that other, and it may be many other, uses will be discovered in medicine, painting, dyeing, varnishing, or pottery, which would certainly contribute to raise the value of a mineral peculiar to this country, and with the nature of which, though so long in our possession, we are still so imperfectly acquainted.

Some part of this surmise has been realized since Mr. Campbell's days, and it may all be so. By far the best account of this mine which we have met with is that of Mr. Parkes, who visited it in 1814.

There are two entrances to the mine,—a small one by which the workmen descend by means of a flight of steps, and the other is a large horizontal one, capable of admitting hand-carts and wheel-barrows for the removal of the rubbish and loose earth by which the black lead is enveloped, and through this entrance the water passes off which constantly runs through the mine.

In order to secure the vast treasure which is contained within this mountain, the proprietors have now erected a strong brick building, consisting of four rooms on the ground floor, one of which is immediately over the opening by which the workmen enter the mine as they go to their work. This opening is secured by a trap door, and the room connected with it is called the dressing room, for when the men enter it, they strip off their usual clothes, and each of them puts on a dress suitable for working in a mine. The men work six hours each, and then they are relieved by others.

As the black lead is cleaned, it is put into firm casks which hold about one hundred and twelve pounds each, and these are sent by waggon to the warehouse of the proprietors in London. Formerly, this mine was opened but once in seven years: but in consequence of the demand being greater, and the quantity which they have discovered not being so large, it has been found expedient to open it and dig for ore during six or seven weeks every year. During this time the mine is guarded night and day. In consequence of the mines having been opened in late years every Summer, they now raise all the black lead they find, and then the mine is securely shut in the following manner:—The workmen wheel back the rubbish which had been removed at the opening of the mine, and this is laid on in a continued heap, to the amount of some hundred cart loads, which securely blocks up both the passages into the mine. The door is then locked as well as the door into the house, and all the men thus leave the premises in a state of safety; for the mass of rubbish which is thus wheeled in at the large door, dams up the small rill of water which usually flows through the mine, and thus has the effect of flooding it completely. Thus, if an attempt were made to break the house and enter the mine by that road, the robbers would find that the water had risen to such a height as would drown any individual who should attempt to search for the ore.

Our readers may be surprised at the extreme caution displayed in every part of these processes, as described by Mr. Parkes, to prevent purloining, &c., but this surprise will cease when we recollect the value of the ore; the market price of the best black lead being nearly half the price of pure silver, about two guineas per pound. Various shafts are excavated in this mine, some of which appear to be exhausted, which occasions a search for new veins in other directions. One mass was discovered in 1803, measuring twenty-one yards and a half in length, and two and a half in diameter.

The property of this mine is shared between a few individuals, and to show its great value, Mr. Parkes states that in sixteen years, from 1798 to 1814, 2552 casks, of one hundred and twelve pounds each, were procured from this mine: of which 736

were fine, and 1816 coarse. This we shall find to give an average, one year with another, of 17,864 lbs.; indeed, the nett profits have been known to be between 20 and 30,000% in one year. The reason why this mine is so particularly valuable, is to be found in the circumstance that the ore requires scarcely any labour to fit it for the market, it being originally almost in a pure state.

Perhaps one of the most remarkable circumstances connected with plumbago is the mode in which it is sold. After the quantity necessary for supplying the market during the ensuing year is extracted from the mine, and the latter closed up, the product is carried in small fragments of about three or four inches long, to London, where it is exposed for sale at the black-lead market, which is held on the first Monday of every month, at a public house in Essex Street, Strand. The buyers, who amount to about seven or eight individuals, examine every piece with a sharp instrument to ascertain its hardness, those which are too soft being rejected. The individual who has the first choice pays forty-five shillings per pound, the others thirty shillings. But as there is no addition made to the first quantity in the market during the course of the year, the residual portions are examined over and over again, until they are exhausted.

Thus much for the black lead. The wooden case or exterior of black-lead pencils is usually made of cedar. Of cedar-trees there are many varieties, but the red cedar used for pencils is the Virginian cedar, (*Juniperus Virginiana*.) of North America.

To prepare the cedar for the pencils, it is cut by a circular saw into four-sided strips of a proper length, and are so arranged as to thickness that two of them together form a square of which one piece is thicker than the other, so as to admit the groove cut to receive the lead, to be confined to one piece only—this groove being made by a common plough plane.

The lumps of plumbago are cut into slices about the thickness of a shilling, by a thin circular saw; the slices being of various sizes, from one to two inches long, and varying in breadth.

In preparing the cylindrical leads for the "patent" pencil cases, for which Mr. Mordan took out a patent, the plumbago slices are cut into square prisms a little larger than are ultimately required; and these prisms are brought to the desired cylindrical form by a gradual process of change, produced by an ingenious contrivance. A series of three different sized circular holes are cut in pieces of ruby; the first of which is of such a size as to convert the square prism of black lead into an eight-sided prism, by cutting off the sharp edge: this eight-sided prism is then converted into one of sixteen sides, by thrusting it through the next smaller hole: and lastly, the cylindrical form is given by the third hole which is just the size required. The manner of thrusting out the lead in a "Mordan's" pencil-case with a little pin inside, will give a good idea of the action of the wire and tube in the above process.

The rubies are worn out in three or four days. Steel does not last above as many hours. So that the ever-pointed pencils are necessarily costly, six of them being sold for 2s. 6d. If they are cheaper than this we may be sure that they are adulterated. In Paris, when you buy a sheet of paper in a stationer's shop, some of these pencils are added to the purchase. Now these are formed of a mixture of plumbago, fuller's earth, and vermicelli.

There is no patent which has been more infringed on than that of Mordan's, for ever-pointed pencils. Birmingham is the source of this infringement, where they are sold as low as three farthings each, formed

of composition. A thousand persons are now engaged in the manufacture of these pencils and cases.

To return to the cedar pencils:—One edge of a slice of plumbago being made straight and even, it is dipped in glue, and inserted into the groove cut in the thicker half of the cedar stick. With a sharp tool a cut is made on each surface of the slice, close to the wood, and the piece can then be broken off, leaving a little prism of lead in the groove. The straight edge of the slice is again dipped in glue, and inserted at the end of the first piece, and again cut off, till the whole length of the groove is filled. The surface of the wood is then smoothed down level, and the other half is glued on, thus making a square black-lead pencil.

The square pencil is brought into the cylindrical form by passing it through a hole in an iron or steel puppet of the exact size of the pencil, and forced along by the workman. On the other side of this puppet is a revolving apparatus, which cuts the pencil round; it consists of two gauges and a small plane iron, revolving round an open centre. Beyond this is a cylindrical hole in a steel plate; as soon, therefore, as the first edge of the pencil is cut round, it is forced into this circular hole, and before the workman has lost the means of pushing it forward at the end that is square, the cylindrical end is pushed through the circular hole, so as to enable him to seize it with a pair of wooden nippers. It is thus pushed and drawn entirely through, and comes out cylindrical and polished, for the hole being a little smaller than the pencil, the latter is compressed in the act of passing through.

The pencils usually hawked about the streets of London are made with the powder of black lead, mixed with melted sulphur, and then poured into moulds, which are frequently reeds or rushes. Common carpenter's pencils are formed in this way, and answer well enough for the purposes to which they are applied. This mode, however, relates to those common pencils in which the lead (so called) is unusually thick; but the most successful attempt at deception is where the pencil has all the outward form and semblance of being well made, but where a process of anatomization shows the purchaser that the amount of black lead is marvellously small,—the central part of the groove being filled with a different substance. In common pencils, gum-arabic and resin are often mixed with the plumbago.

Genuine cedar pencils must cost at least sixpence each. Pencils of a spurious kind are, however, sold as low as 4½d. per dozen. The melting or softening of the lead when held in a candle, or applied to a red-hot iron, and yielding a blueish flame with a strong smell like that of burning sulphur, will at once detect the nature of their composition. Pencils so made are of a very bad kind; they are hard, brittle, and do not cut or make a mark freely, either on paper or on wood, rather cutting or scratching them than leaving a coloured stroke.

Drawing pencils are distinguished by the hardness or softness of the selected specimens of plumbago from which they are manufactured, and, accordingly, those made from the hard mineral, have H or HH stamped upon the cedar, and those of a soft or very soft nature are distinguished by B or BB, technically, however, B and double B, as in the former case H and double H.

Black-lead pencils appear to have been known for nearly two centuries, for a writer of about 200 years ago, says,—“Of late black lead is curiously formed into cases of deal or cedar, and so sold as dry pencils something more useful than pen and ink.”