

Suggestions for the use of the Blowpipe by working Miners. BY JOHN

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Continued from p. 166.*

When a metallic bead is produced, it may be pure silver, tin, lead, bismuth, copper, gold; or iron, copper, nickel, or cobalt, alloyed with arsenic; or a mixture of various metals.

Gold and silver may be distinguished by not losing their brilliancy in the outer flame; tin by its whiteness and softness; lead and copper are immediately distinguished by their colour; and bismuth by fuming and evaporating in the reducing flame. The arsenical alloys and compounds, not clearly distinguishable by these means, nor by their streak upon the black flint, must be examined by fluxing with borax.

If it give green on pipe-clay, it is copper, though it happen to be bleached by the arsenic.

If blue, it is cobalt.

If orange-yellow while hot, and the colour fly on cooling, it is iron or nickel; and these are distinguished by the reducing flame on charcoal, where the borax bead is bottle-green with iron, but almost colourless with nickel.

If the metal yield no bead, but pass off in vapour, it is quicksilver, arsenic, antimony, bismuth; or, possibly, tellurium, cadmium, or zinc.

If the vapour smell strongly of garlic, it is arsenic.

If it leave a circular halo on the charcoal, it is antimony, tellurium, bismuth, or cadmium.

If the halo be white, it is antimony.

If orange-yellow, it is to be subjected to the reducing flame. If it disappear easily, tinging the flame green, it is tellurium.

If it evaporate with difficulty, and without tinging the flame, it is bismuth.

If it be red, or orange-red, it is cadmium.

If the mineral evaporate readily with no odour, or only that of sulphur, and without leaving a white or yellow halo, it probably contains quicksilver; which is proved, if, on mixing a portion of it with soda and iron filings, heating it on charcoal, and holding a bit of gold coin on the vapour, the quicksilver will show itself on the coin.

If, using soda with the reducing flame, the assay burn, after a while, with a pale-green flame and white smoke, covering the charcoal with a white flaky powder, it contains zinc.

If it will neither yield a bead of metal nor volatilize, but attract the magnetic needle after the operation of the reducing flame, it most probably contains iron; but it may be nickel or cobalt: easily distinguished by fluxing with borax.

If the mineral, or the residue, after part has evaporated, will neither yield a bead, volatilize, nor attract the magnetic needle, we have then to flux it with borax; and the following table will show what it contains:—

* Erratum. At page 161 third line from bottom for PRIDEAUX, read PRIDEAUX.

| In the reducing flame, on charcoal. | If it stain the borax | | The metal is | Estimation. |
|-------------------------------------|---|--|--------------|---|
| | In the calcining flame, on pipe-clay. | | | |
| Blue | Blue | | Cobalt | { Valuable, for Colour- ing glass, &c. Ditto, and for Paints. Valuable. |
| Bright green | Colourless | | Chrome | |
| Colourless, or reddish | Bluish green | | Copper | |
| Bottle-green | { Orange, while hot; Bleaches in cooling. } | | Iron | { Of no value unless near coal. |
| Pale | | | Nickel | |
| Dirty green | As iron | | Uranium | Valuable. |
| Purple | Yellow | | Titanium | Not used. |
| Colourless | Colourless | | | Ditto. |
| | Purple | | Manganese | { Valuable, for bleach- ing, &c. |

Copper is reduced to the metallic state, in the reducing flame; and hence, when in quantity, shows itself in its usual red colour, in the bead.

In mixtures of metals, the indications are sometimes ready enough. If on pipe-clay, we find the borax tinged between orange and purple while hot, and becoming purple on cooling, whilst it gives a bottle-green on charcoal, we immediately perceive the indications of iron and manganese; a very common mixture.

If again, we find it bright green on pipe clay, and emerald-green on charcoal, a mixture of chrome and copper is indicated.

But it more frequently happens that mixtures of metals give ambiguous results; and that they can only be ascertained by caution and perseverance.

Although most of this is sufficiently easy, it requires a little practice: and, to give the operator confidence in his results, this is best performed upon substances which he knows to contain the metals he assays for. Thus, if he operate on common mundic, he is certain, after a sufficient time of roasting and heating on charcoal, to obtain a residuum capable of affecting the magnetic needle. White mundic will leave the same residue, after giving off an arsenical smoke. Green copper (malachite) will be sure to yield a bead of copper on charcoal, and will as certainly produce a fine green with borax on pipe-clay. Any of the ores of lead may be promptly reduced to a metallic bead on charcoal.

The vapour of antimony may be easily distinguished from that of arsenic by the garlic odour of the latter.

A minute particle of manganese will tinge borax a fine purple, on pipe-clay, in the outer flame; but on charcoal, in the blue flame, a much larger portion, dissolved in borax, will become limpid and colourless. A particle of titanium ore will give an opposite result, bleaching on the pipe-clay, and becoming purple on the charcoal.

The experimenter should also not fail to reduce tin ore by the aid of soda, and some ore of zinc by the same means, that he may become acquainted with the appearances in these assays.

Thus varying his practice as materials happen to fall in his way, he will quickly acquire familiarity with the appearances and results, and feel confidence in any assay he may undertake.

Should he wish to carry his investigation farther, and ascertain the pro-

portion of metal contained in the ore, this may be done on a small fragment of any thing which yields a regulus ; and by an instrument so simple that a clever workman may make it for himself.

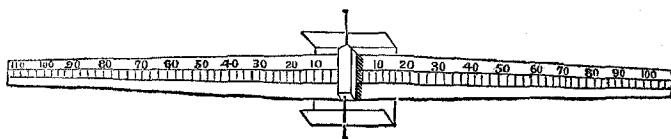
The common marsh-reed, growing in such places, generally, throughout the Kingdom, will yield straight joints, from eight to twelve, or more, inches long. An eight-inch joint will serve, but the longer the better. This joint is to be split down its whole length, so as form a trough, say a quarter of an inch wide in the middle, narrowed away to $\frac{1}{8}$ of an inch at the ends. A narrow slip of writing-paper, the thinner the better (bank-post is very convenient for the purpose,) and as long as the reed trough, is to be stuck, with common paste, on the face of a carpenter's rule, or, in preference, that of an exciseman, as the inches are divided into tenths instead of eighths; in either case observing that the divisions of the inch on the rule be left uncovered by the paper. When it is dry, lines must be drawn the whole length of it, $\frac{1}{8}$ of an inch apart, to mark out a stripe $\frac{1}{8}$ of an inch wide. Upon this stripe the divisions of the inch are to be ruled off, by means of a small square.

The centre division being marked O, it is to be numbered at every fourth line, to the ends. Thus the fourth from the centre on each side will be 10; the 8th, 20; the 12th, 30; the 16th, 40, &c.; and a slip of 10 inches long, graduated into 10ths of an inch, will have on each arm 50 lines, or 125 degrees, divided by these lines into quarters. While the lines and numbers are drying, the *exact centre* of the reed-trough may be ascertained, and marked *right* across by spots on the two edges. A line of gum-water, full $\frac{1}{8}$ of an inch wide, is then laid, with a camel's-hair pencil, along the hollow; and the paper being stripped from the rule (which it leaves easily,) the graduated stripe is cut out with scissors, and laid in the trough, with the line O exactly in the centre. Being pressed close to the gummed reed, by passing the round end of a quill along it, it graduates the trough from the centre to each end. This graduation is very true, if well managed, as the paper does not stretch with the gum-water, after being laid on the rule with paste.

A very fine needle is next to be procured (those called *bead-needles* are the finest,) and passed through a slip of cork, the width of the centre of the trough, about $\frac{1}{4}$ of an inch square, and $\frac{1}{8}$ thick. It should be passed through with care, so as to be quite straight. The cork should then be cut, until one edge of it fits into the trough; so that the needle shall bear on the edges, exactly in the spots that marked the centre, as it is of importance that the needle and trough be exactly at right angles to each other. The cork is now to be fixed in its place with gum-water, and, when fast dry, to be soldered down on each side with a small portion of any soft resinous cement, on the point of a wire or knitting-needle. A little cement being also applied in the same manner to the edges of the cork where the needle goes through, to give it firmness, the beam is finished. It may be balanced by paring the edges on the heaviest side; but accurate adjustment is needless, as it is subject to vary with the dampness or dryness of the air.

The support on which it plays, is a bit of tin plate (or, in preference, brass plate) $1\frac{3}{8}$ inch long and 1 inch wide. The two ends are turned up square $\frac{3}{8}$ inch, giving a base of $\frac{5}{8}$ inch wide, and two upright sides $\frac{3}{8}$ high. The upper edges are then rubbed down smooth and square upon a Turkey stone, letting both edges bear on the stone together, that they may exactly correspond. For use, the beam is placed evenly in the support, with the needle resting across the edges. Being brought to an exact balance by a

bit of writing paper or any other substance placed on the lighter side, and moved toward the end until the equilibrium is produced; it will turn with extreme delicacy, a bit of horse-hair $\frac{1}{8}$ inch long being sufficient to bring it down freely.



This is used as follows.

A suitable fragment for an assay of the mineral to be tried is placed on one side of the beam, and counterpoised by a small weight, or any other substance, on the other side: on No. 100, if the produce be required per cent. (but if per cwt., on the line beyond No. 110;) the assay piece being moved to or from the centre, until the balance is adjusted. Its exact place on the beam being then noted, it is to be taken off and reduced in the usual manner.

When the reduction is complete and the particles of metal have been brought together into one bead, it is allowed to cool, and, being broken out of the soda (if any was used,) is replaced on the beam precisely where it stood before.

The counterpoise will now require to be moved toward the centre, in proportion to the loss of the assay. The number on which it stands, when the balance is restored being multiplied by 10, will give the produce per cent. or per cwt., according to the first position of the counterpoise.

A beam of this kind is described in the "Annals of Philosophy," of a graduated thin slip of deal, the needle fixed on with sealing-wax; but this is rather troublesome to graduate, the polish of the needle is apt to be impaired by the heat; its greater weight also interferes with its delicacy, and a blowpipe bead is very subject to fall off its flat surface. On these accounts, I find the reed beam an improvement. Brass plate is, however, where procurable, preferable to tin plate for the supports: and still much better, two straight bits of fine glass rod or tube, fixed with cement on the edges of a groove, in a piece of wood of the requisite dimensions.

The utility of the information contained in this article, both to the miner and the student in mineralogy, induces us to add a few remarks on the same subject, in order that it may be complete in the present number.

Trusting that our endeavours to facilitate the rudiments of this interesting study, will meet the indulgence and assistance of our more scientific readers, we shall proceed to observe, that as the lamp described by Berzelius, or one of a similar kind, may be almost as easily procured as the miner's candle, it will be found of some importance to employ it in preference, in all cases where it is attainable. It is necessary that the operator should perceive distinctly the conical flame and transparent vapour emanating from the blast; and this desideratum will be effected with much more convenience by using a lamp.

The wick should be cut obliquely, the most elevated part being on the right hand; a longitudinal opening being made for the insertion of the blow-

pipe; care must be taken to use oil which has not been purified by sulphuric acid, for the reason that the acid will always remain in sufficient quantity to effect the texture of the wick, and change the colour of the vapour produced. The cotton should also be in its raw state, or a similar effect may be produced by the presence of the chloruret of lime, which is sometimes used in the process of bleaching.

Until the flame can be well and readily distinguished by the operator, a darkened room will be the best adapted for his experiments; he will soon observe that, when the assay is brought in contact with the interior flame, the surrounding vapour will change its colour from blue to an orange-yellow, the intensity of which will depend on the nature of the substance submitted to the action of the flame. This vapour gradually diminishes and disappears, and the assay becomes surrounded by an atmosphere of a scarcely visible blue tinge, or takes a colour peculiar to the assay which is volatilized at this period of the process.

The carbonate and sulphate of strontian give, at first, a pale vapour, which is succeeded by a most brilliant and permanent red. The same colour is also produced from fluor spar, more intense, but of less brilliancy, and a weaker tinge is given out from the sulphate of lime; arsenic colours the outward flame of a clear blue; antimony somewhat deeper; and lead, a fine azure; green is evolved from boracic acid; minerals containing barytes communicate a paler tinge, but the colour does not become apparent until the assay begins to melt, after which, it increases in brightness and beauty for a considerable time; borax has, at first, a dense reddish atmosphere, and does not exhibit the green colour unless sprinkled with sulphuric acid; minerals containing copper, even in very small quantity, produce a fine green at the extremity of the blue jet; lead ores, holding copper in combination, have a similar appearance, the jet being in this case of a finer blue. The presence of potassium is discovered by fusing a portion of oxide of nickel with borax, and submitting the compound, in conjunction with the assay, to the action of the flame; if it contain potassium, a mass of blue glass will be the product.

These and the preceding indications will be a sufficient guide to the student in very many cases, and his own observations on the process during the experiments will enable him to pursue his study with pleasure, and, possibly, with profit.

Mining Review.

English Patents.

Specification of the patent granted to THOMAS ROUTLEDGE, and ELIJAH GALLOWAY, of the City of London, for Improvements in Cabriolets and Omnibuses.—Sealed December 19, 1836.

Figs. 1, 2, 3, 4 exhibit our improvements in omnibuses. The body instead of having straight and parallel seats with an entrance behind is divided into two equal parts, *a, b*. The passengers, therefore enter, at either side into the space, *c*, and through the doorways, *o, o*, sitting on the circular seats, *d, d, d, d*, as will be clearly seen by the sectional plan, fig. 5, and which, therefore, it is unnecessary more minutely to describe. The wheels are all of equal size, and in turning the carriage they all lock; thus differing from other four-wheel carriages, the fore-wheels only of which can lock.

The mode in which this improvement is effected may be thus explained, *e, e*, are two springs on the top of each body, which springs have a hole