

CHEMISTRY

Arsenic, Antimony and Bismuth

"A Classic of Science"

These Elements in One or Another of Their Compounds
Were Well Known to the Alchemists of the Middle Ages

Arsenic

COLLECTION DES ANCIENS ALCHIMISTES GRECS publiée sous les auspices du Ministère de l'Instruction publique par M. Berthelot, avec la Collaboration de M. Ch.-Em. Ruelle. Première Livraison, comprenant: Introduction avec planches et figures en photogravure; Indications Générales.—Traité Démocrite (Democrite, Synésius, Olympiodore); Texte Grec et Traduction Française avec variantes, notes et commentaires. Paris, Georges Steinheil, 1887.

COLLECTION OF ANCIENT GREEK ALCHEMISTS published under the auspices of the Ministry of Public Instruction by M. Berthelot¹ with the collaboration of M. Ch.-Em. Ruelle. First part, comprising: Introduction with plates and figures in photogravure; General remarks.—Democritian Treatises (Democritus, Synesius, Olympiodorus); Greek Text and French Translation with variants, notes and commentaries. Paris . . . 1887. Translated for the SCIENCE NEWS LETTER by Helen M. Davis. This is a literal translation from the French and Greek texts.

OLYMPIODORUS, PHILOSOPHER OF ALEXANDRIA.

FIRST TINCTURE, coloring copper white by means of arsenic, as follows.

Arsenic (sulphide) is a kind of sulphur which volatilizes quickly; that is to say, volatilizes over the fire. All substances similar to arsenic are also called sulphurs and volatile bodies. Now the preparation is made thus: taking 14 ounces of lamellar arsenic the color of gold, cut it into pieces,

¹Berthelot is the authority on the earliest alchemists whose Greek texts are preserved in libraries of Europe. Olympiodorus was a Greek historian and alchemist who was born in Thebes, Egypt, in the latter part of the fourth century A.D. In 412 he was a member of an embassy sent by the Emperor Honorius to Attila, the Hun.

grind it so as to reduce it to particles as fine as down; then soak it in vinegar for two or three days and as many nights, the material being closed up in a glass vessel with a narrow neck, carefully luted at the top so that it shall not be dissipated. Shaking once or twice a day, do this for several days; then, emptying the vessel, wash with pure water, only just until the odor of vinegar has disappeared. Guard the most subtle part of the substance; and do not let it be thrown out with the water. After allowing the mass to dry and contract in the air, mix and pulverize with 5 ounces of salt of Cappadocia.

Now the use of the salt was devised by the ancients to avoid the arsenic sticking to the glass vessel. This glass vessel is called *asympton* by Africanus. It is luted with clay; a glass cover in the shape of a cup is placed above. At the upper part, another cover envelops the whole; it is fastened tightly on all sides, so that the distilled arsenic may not be dissipated.²

Then distill it repeatedly and pulverize it, until it becomes white; thus we obtain a white and compact alum.³ Then melt the copper with some hard Nicean copper; then take some of the flower of soda and throw into the bottom of the crucible 2 or 3 parts to flux it. Next add the dry powder (sublimed arsenic), with an iron ladle; put in the amount of one ounce to 2 pounds of copper. After that, put into the crucible for each ounce of copper a little silver, with a view to making the color uniform. Then throw into the crucible again a small amount of salt.

²This description corresponds to that of an apparatus for sublimation, formed of a lower receptacle surmounted by two covers or heads, nested one inside the other in the form of an aludel. The latter apparatus has been attributed to the Arabs; but the actual description makes it go back as far as Africanus (III century). It was carefully luted; and the part sublimed was condensed in these heads.

³By this operation, orpiment or sulphide of arsenic is slowly oxidized, in such a way as to change it into arsenious acid. We see that the latter is here called by the name of white alum.

You will thus have a very fine *asem* [alloy].

Antimony

THE TRIUMPHANT CHARIOT OF ANTIMONY, being a conscientious discovery of the many real transcendent Excellencies included in that Mineral. Written by Basil Valentine⁴, a Benedictine monke, faithfully Englished and published for the common good. By I. H. Oxon. London: Printed for W. S. and are to be sold by Samuel Thomson at the Bishop's Head in Pauls Church Yard. 1661. This is an exact reprint of extracts from the original publication.

He that will write of Antimony, needs a great consideration and most ample minde, and various rules of its preparation and assured end; wherein it may with profit be used, that so he may give a certain undoubtful testimony of what is good or what is evil, what helpful and what poisonous.

'Tis no small thing truly to search out Antimony, thereby to know its essence and, at length by dilligence and experience, to obtaine the knowledge of it, to take away its poison, (so much cryed out against by the clamours of the vulgar) and by a better omen to transmute it into wholesome medicine. Many inquirers or Anatomists have hunted some here, some there, and miserably handled, tormented, and crucified Antimony, in so much that 'tis both inexpressible and incredible. But (really) they have not found out, or accomplished any profitable operation, wandring from the true end, propounding to themselves things that are false, and thereby shadowing their sight, from being able to discern the mark.

Antimony may deservedly be compared (& also Mercury) to an infinite Circle, and painted with all sorts of colours, and by how much the more it is sought into, so much the more is found out and learned, (so that your progresse therein be right and true.)

⁴Basil Valentine who claimed to be a Benedictine monk, was one of the late alchemists, and was an upholder of the salt-sulphur-mercury doctrine. There is considerable mystery about him, as his name never appears in the records of members of the Benedictine order.

In a word, one mans life is too too short, perfectly to be acquainted with its mysteries.

It is the worst of Poysons, the which being separated therefrom, it becomes the supremest medicine, and is to be administered for inward and outward diseases, Which to many minds will seem incredible, and will be adjudged vanity and folly, but yet may be pardonable in them, because of their ignorance and want of judgment: but verily they are exceedingly to be blamed, who not knowing, have no desire after knowledge nor any will to learn.

Antimony hath four qualities, it is hot and cold, moist and dry, and imitates the four seasons of the year: it is also fixt and volatile: the volatile part is not void of poyson, but the fix'd part is altogether free there from.

Hence it comes to passe, that many unskilful men write that they neither know, nor understand, which may (for that reason) be adjudged monstrous, & one of the seven wonders of the world: there being none that either hitherto hath bin found or is at present to be found, who hath fundamentally learned all its faculties, virtues, and powerful operations, or hath so far tryed its force & efficacy, that nothing more may be therein seen, then he by his own experience knows. If any such can be met withall, he is well worthy to be drawn in the Triumphant Glorious Chariot of the ancient Emperours, when they had gotten some notable victories: But in my opinion the chariot Smiths are likely of but light employment about chariots of this kind: many artificers in this age being overwhelmed with their thoughts, have sought after Riches only in Antimony, and have neglected the benefit that its wont to bring to such as are diseased, the which utility ought not-

LITTLE OROHIPPIUS

. . . roamed the plains of western United States during the Eocene epoch, but long before the Spaniards reintroduced the horse to this continent all descendants of Orohippus had become extinct. The Orohippus will be described by its discoverer,

O. C. Marsh

IN THE NEXT CLASSIC OF SCIENCE

withstanding first of all to be sought after, that the wonders of the Lord may be manifested, and due thanks given unto him. It cannot indeed be denied, but that in Antimony Riches may be found, although neither thou nor I may beleve it, since both of us are but Scholars and Disciples in its search; although haply I have seene more therein, and experimented more, then either thou or such as thou art (that boast exceedingly much, and arrogate a large portion of Learning to themselves) are able to learn to morrow or next day; yet let none grieve at his fortune, nor despaire, for God doth wonderfully distribute his mercifull rewards; but yet the World abounds with such as are ungratefull, who contemn the blessings of God, esteeming Wealth better than true riches, and therefore God hath set a Cloud before their eyes, that such being blinded, may not know those secrets that lie hid under a Metallick Form. . . .

Now therefore, having decreed to deliver a perfect, and my absolute opinion of Antimony, I think convenient to speak a few words touching its name: Observe therefore, It was formerly called by the *Arabians*, *Asinat*; by the *Chaldeans*, *Stibium*; by the *Latines* 'tis to this day called *Antimonium*; but the Germans, (studious in their own proper Language) call it *Spisglasse*, i. e. speared or radiated Glass, because its substance is in such a form, and out of it may be made Glass (either apart, or by addition) of divers colours, lying hid therein, and educible therefrom. Let every one on that acount consider, that the Observations of the *Chaldeans*, *Arabians*, *Latines*, *Germans*, and other People, about Antimony, were not in vain, but that both its vertue and use might equally and deservedly be taken notice of, and 'tis very likely and credible, that by succeeding Heresie its praise and virtue died, for truth may be oppressed by the enemies violence, the Devil being by God permitted to act many things, because of our Transgressions and blindness.

Bismuth

GEORGIUS AGRICOLA⁵ DE RE METALLICA translated from the first

⁵Agricola, who was not an alchemist at all, but a serious student of mining and metallurgy, wrote several books besides the famous "De Re Metallica," among them the "Bermannus," from which this description of bismuth ore is taken. The "Proberbüchlein and Nütliche Bergbüchlein" to which Mr. Hoover refers were anonymous handbooks for miners, in wide circulation in Agricola's day.

Latin edition of 1556, with biographical introduction, annotations and appendices upon the development of mining methods, metallurgical processes, geology, mineralogy & mining law from the earliest times to the 16th century, by Herbert Clark Hoover and Lou Henry Hoover. Published for the Translators by The Mining Magazine, Salisbury House, London, E.C., 1912. This is an exact reprint of footnote 59, Book IX.

In *Bermannus* [Agricola] says:

"*Bermannus*.—I will show you another kind of mineral which is numbered amongst metals, but appears to me to have been unknown to the Ancients; we call it *bisemutum*.

"*Naevius*.—Then in your opinion there are more kinds of metals than the seven commonly believed?

"*Bermannus*.—More, I consider; for this which just now I said we called *bisemutum*, cannot correctly be called *plumbum candidum* (tin) nor *nigrum* (lead), but is different from both, and is a third one. *Plumbum candidum* is whiter and *plumbum nigrum* is darker, as you see.

"*Naevius*.—We see that this is of the colour of *galena*.

"*Ancon*.—How then can *bisemutum*, as you call it, be distinguished from *galena*?

"*Bermannus*.—Easily; when you take it in your hands it stains them with black unless it is quite hard. The hard kind is not friable like *galena*, but can be cut. It is blacker than the kind of crude silver which we say is almost the colour of lead, and thus is different from both. Indeed, it not rarely contains some silver. It generally shows that there is silver beneath the place where it is found, and because of this our miners are accustomed to call it the 'roof of silver.' They are wont to roast this mineral, and from the better part they make metal; from the poorer part they make a pigment of a kind not to be despised."

This pigment was cobalt blue, indicating a considerable confusion of these minerals. This quotation is the first description of bismuth, and the above text the first description of bismuth treatment. There is, however, bare mention of the mineral earlier, in the following single line from the *Proberbüchlein*: "Jupiter (controls) the ores of tin and *wismundt*." And it is noted in the *Nütliche Bergbüchlein* in association with silver.