CHEMISTRY

Zinc, Cadmium and Mercury

"A Classic of Science"

A Modern Metal, an Ancient One and the First Metal To be Added to the Alchemists' Famous Group of Seven

Zinc—Paracelsus, About 1530 A. D.

THE HERMETIC AND ALCHEMICAL WRITINGS OF AUREOLUS PHILIPPUS THEOPHRASTUS BOMBAST, OF HOHENHEIM, CALLED PARACELSUS THE GREAT. Now for the first time faithfully translated into English. By Arthur Edward Waite. In two volumes, Vol. I. London: 1894.

SUCH and so many in number are the metals, as I have reckoned them up, namely, gold, silver, tin, lead, iron, steel, female copper, and male copper. Thus they are eight in number. But if—as cannot be the case—iron and steel, and male and female copper respectively, are reckoned each as one metal, there would be only six, and the arrangement would be inconvenient. There are seven well-defined and publicly known metals: gold, silver, tin, lead, iron, steel, and copper, the last being reckoned as one metal, since the male and female are wrought together and not separated, as they ought to be.

Of Mixed Metals:

You perceive, from what has been already said, that the male is not always solitary without a consort, but often they co-exist, as in the cases of gold and silver, iron and steel, which grow together in one working, from which each retains its own special nature, but still they are mixed so that one does not impede the other, nor are they of their own accord separated one from the other. Such, too, is often the case with tin and lead. But where they are thus joined no good result ensues from them. They do not square into one body; but it is better that each should be separated into its own body.

Concerning Spurious Metals:

Metals can be adulterated. Only gold and silver mix with the other metals, for the reason that they are the most subtle. Only, therefore, when such a primal matter is present, does each grow up together by itself. It may easily be that six or seven different fruits shall be grafted together on the same tree; and there is the same marvellous kind of implantation here in Nature.

Concerning Zinc:

Moreover, there is a certain metal, not commonly known, called zinc. It is of peculiar nature and origin. Many metals are adulterated in it. The metal of itself is fluid, because it is generated from three fluid primals. It does not admit of hammering, only of fusion. Its colours are different from other colours, so that it resembles no other metals in the condition of growth. Such, I say, is this metal that its ultimate matter, to me at least, is not yet fully known. It does not admit of admixture; nor does it allow the fabrications of other metals. It stands alone by itself.

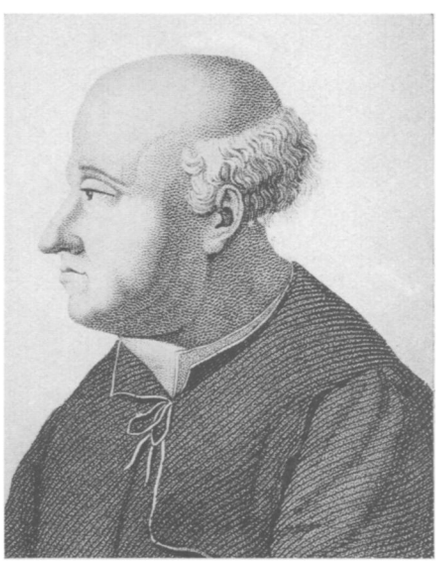
Concerning Quicksilver:

There is, moreover, a certain genus which is neither hammered nor founded; and it is a mineral water of metals. As water is to other substances, so is this with reference to metals. So far it should be a metal as Alchemy reduces it to malleability and capacity of being wrought. Commonly it has no consistence, but sometimes it has. The right opinion about it is that it is the primal matter of the Alchemists, who know how to get from it silver, gold, copper, etc., as the event proves. Possibly also tin, lead, and iron can be made from it. Its nature is manifold and marvellous, and can only be studied with great toil and constant application. This, at all events, is clear, that it is the primal matter of the Alchemists in generating metals, and, moreover, a remarkable medicine. It is produced from Sulphur, Mercury, and Salt, with this remarkable nature that it is a fluid but does not moisten, and runs about, though it has no feet. It is the heaviest of all the metals.

Cadmium—Stromeyer, 1818

NEW DETAILS RESPECTING CADMIUM. By M. Stromeyer. In Annals of Philosophy; Vol. XIV, October, 1819 (From Annalen der Physik, lx. 193).

M. STROMEYER has communicated to the Royal Society of Göttingen, at the meeting of Sept. 10, 1818, the first part of his researches on the new metal which he discovered in zinc and its oxides, and to which he has given the name of *cadmium*. Assisted by two of his pupils, M. Mahner, of Brunswick, and M. Siemens, of Hamburgh, he has not only verified his first results, but has been able to give a greater extent to his researches, and to reduce them to a great degree of precision. He states that he has explained more fully the circumstances which led to the discovery of cadmium; and in that way has shown the part which M. Hermann, of Schoenbeck, and Dr. Roloff, of Magdeburg, had in it. He gives likewise the names of the different species of zinc, of its oxides, or of its ores, which contain cadmium. Among these last, M. Stromeyer has found it only in a very small proportion in some blends with the exception of some



"PARACELSUS",

Theophrastus Bombast, namesake of the famous Greek philosopher. His surname has given us the adjective "bombastic," which tells what his contemporaries thought of this medieval alchemist and physician.

varieties of radiated blende of Przibram, in Hungary, which contains two or three per cent. of it. He likewise gives the process for procuring cadmium in a state of purity.

According to this process, we begin by dissolving in sulphuric acid the substances which contain cadmium, and through the solution, which must contain a sufficient excess of acid, a current of sulphuretted hydrogen gas must be passed. The precipitate formed is collected and well washed. It is then dissolved in concentrated muriatic acid, and the excess of acid driven off by evaporation. The residue is dissolved in water, and precipitated by carbonate of ammonia, of which an excess is added to redissolve the zinc and the copper that may have been precipitated by the sulphuretted hydrogen gas. The carbonate of cadmium, being well washed, is heated to drive off the carbonic acid, and the remaining oxide is reduced by mixing it with lamp-black, and exposing it to a moderate red heat in a glass, or earthen retort.

The colour of cadmium is a fine white, with a slight shade of bluish-grey, and approaching much to that of tin. Like this last metal, it has a strong lustre, and takes a good polish. Its texture is perfectly compact, and its fracture hackly. It crystallizes easily in octahedrons, and presents at its surface on cooling the appearance of leaves of fern. It is soft, very flexible, and yields readily to the file, or the knife. It stains pretty strongly; however, it is harder than tin, and surpasses it in tenacity. It is likewise very ductile, and may be reduced to fine wires, or thin plates; yet, when long hammered, it scales off in different places. Its specific gravity, without being hammered, is 8.6040, at the temperature of 62°; when hammered, it is 8.6944. It melts before being heated to redness, and is volatilized at a heat not much greater than what is necessary to volatilize mercury. Its vapour has no peculiar odour. It condenses in drops as readily as mercury, which, on congealing, present distinct traces of crystallization.

Cadmium is as little altered by exposure to the air as tin. When heated in the open air, it burns as readily as this last metal, and is converted into a brownish-yellow oxide, which appears usually under the form of a smoke of the same colour; but which is very fixed. Nitric acid dissolves it easily cold; diluted sulphuric acid, muriatic acid, and even acetic acid, attack it with disengagement of hydrogen gas; but their

FRIEDRICH STROMEYER

Discoverer of the metal cadmium, one of the leaders of early nineteenth century mineralogical chemistry.

action is very feeble, especially that of acetic acid, even when it is assisted by heat. The solutions are colourless, and are not precipitated by water.

Mercury—Theophrastus, About 300 B. C.

THEOPHRASTUS'S HISTORY OF STONES. With an English Version and Notes. By Sir John Hill. London: M DCC LXXIV (1774).

THERE are also two kinds of Cinnabar, the one native, the other factitious; the native, which is found in *Spain,* is hard and stony; as is also that brought from *Colchis,* which they say is produced there in Rocks and on Precipices, from which they get it down with Darts and Arrows. The factitious is from the Country a little above *Ephesus;* it is but in small Quantities, and is had only from one Place. It is only a Sand, shining like Scarlet, which they collect, and rub to a very fine Powder, in Vessels of Stone only; and afterwards wash in other Vessels of Brass, or sometimes of Wood: What subsides they go to work on again, rubbing it and washing it as before. And in this Work there is much Art to be used; for from an equal Quantity of the Sand some will make a large Quantity of the Powder, and others very little, or none at all. The Washing they use is very light and superficial, and they wet it every time separately and carefully. That which at last subsides is the Cinnabar, and that which swims above in much larger Quantity is

only the superfluous Matter of the Washing.

It is said, that one *Callias,* an *Athenian,* who belonged to the Silver Mines, invented and taught the making of this artificial Cinnabar. He had carefully got together a great Quantity of this Sand, imagining, from its shining Appearance, that it contained Gold: But when he had found that it did not, and had had an Opportunity, in his Trials, of admiring the Beauty of its Colour, he invented and brought into use this Preparation of it. And this is no old Thing, the Invention being only of about ninety Years Date; *Praxibulus* being at this Time in the Government of *Athens.*

From these Accounts it is manifest, that Art imitates Nature, and sometimes produces very peculiar Things; some of which are for Use, others for Amusement only, as those employed in the ornamenting Edifices; and others, both for Amusement and Use. Such is the Production of Quicksilver, which has its Uses: This is obtained from native Cinnabar, rubbed with Vinegar in a brass Mortar with a brass Pestle. And many other Things of this kind others, perhaps, may hit upon.

Science News Letter, January 31, 1931

CHEMISTRY

Hydrogenation to Bring Better Oils and Gasoline

SUPERIOR lubricating oils and gasoline prepared by combining lower grade oils with hydrogen are going to produce a marked gain in automobile engine efficiency.

Details of the engineering advantages of the new products were described in Detroit before the annual convention of the Society of Automotive Engineers, by R. T. Haslam and W. C. Bauer, of the Standard Oil Development Co.

This method of treating crudes and low grade oils with hot hydrogen under a pressure of 4000 pounds per square inch has been developed jointly by the German I. G. Farbenindustrie and the Standard Oil Company of New Jersey. The possible other use of hydrogenation in producing gasoline artificially from coal makes it of immense economic importance. So it has been the subject of much experimentation.

Hydrogenation improves the quality of the oil for lubricating or fuel purposes in three ways. Unwanted nitrogen, oxygen or sulphur compounds are removed as gas. The hydrogenated product has better keeping qualities. Also resinous or gummy substances are found to be absent after the treatment.

Hydrogenated lubricating oils which can be made from common crude unrefined oils are superior to the highest grade natural lubricants now available.

The new gasolines are richer in the naphthenic or ring hydrocarbons and therefore superior in antiknock properties. As they can be made from low grade oils the saleable yield of gas is increased. There is no reason why the use of hydrogenated gasoline should not become widespread and the way thus opened to the engineer to design engines operating at greater compressions, higher temperatures and higher speeds than at present.

Science News Letter, January 31, 1931

PLANT PHYSIOLOGY-MEDICINE

Effects of Liver Extract On Plants and Man

THE most effective cure for anemia, liver extract, seems to be effective also in checking the pale yellowness of plants grown in the dark, which is a kind of vegetable anemia. Prof Oran Raber of Immaculata College, Pennsylvania, has found. He reported results of his experiments to the American Association for the Advancement of Science in Cleveland.

Plants kept in the dark and fed with liver extract kept their green color much longer than did others not so treated, This suggests, Prof. Raber pointed out, a physiological relationship between hemoglobin, the red coloring matter of the blood, and chlorophyl, the green coloring hatter of plants. The evolutionary relationship between these two pigments has long been a matter of botanical study.

A case of bronchial asthma caused by eating liver and subsequently by taking liver extract has been reported to the American Medical Association by Dr. Edward Matzger of San Francisco. The liver was taken to treat the primary anemia from which the patient suffered.

He had suffered from asthma about 15 years ago, but on moving to the country the asthma improved greatly and remained so even after his return to the city eight years later, complaining of symptoms of anemia. The liver treatment relieved the anemia, but after one week of the liver diet the asthma became constant and persisted until the liver was discontinued. The same thing occurred when liver extract was taken.

Dried hog's stomach made a satisfactory substitute for the liver. It relieved the anemia without causing the asthmatic attacks. The patient was then immunized to rye pollen and house dust and thus freed of the asthma.

Science News Letter, January 31, 1931

ELECTRICITY

New Cable Sends 2500 Letters a Minute

ONE OF the latest advances in telegraphic communication, a cable between Newfoundland and the Azores over which 2500 letters a minute can be sent in one direction or 1400 letters in each direction at the same