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On the thermoelectric power of iron and platinum in vacuo

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these mountain chains, we have first granite; and this is flanked by Subcarboniferous limestone, in most places so crystalline as to obliterate all traces of fossils. Protruding through these, and forming the mountain-peaks, we have porphyry, quartzites, basalt, diorites, and trachytes.

The country rock in the immediate vicinity of the antimony-mines is quartzite and limestone. The lodes are from four to twenty feet wide; and exploitation work, carried to a depth of thirty feet, shows that the fissures are filled from wall to wall with the oxide of antimony, almost pure and remarkably uniform in character. The course of the lodes is nearly north and south; the pitch is high to the east. The area over which the ore is found may be roughly stated to be five or six miles long and half a mile or more wide.

The Boston Company controls nine mines, each of which is a full Mexican claim, 800 metres (2624 feet 8 inches) long and 200 metres (656 feet 2 inches) wide. On three of the mines the crop, which is solid oxide of antimony, stands up boldly above the general surface, and may be traced along the claims for many hundred feet. As stated above, the ore, so far as explorations have exposed it, is almost pure oxide of antimony, the little impurity it contains being silica. The fire assays show it to contain from 60 per cent. to 70 per cent. of pure metal; and I have estimated the entire lode to average 50 per cent. By selection the average may be augmented. On going down to a greater depth in the lode, it is possible that the oxides may give place to sulphides; but thus far there is not the slightest evidence of any change.

This discovery is destined to produce a marked influence upon the production of metallic antimony, and to greatly extend its uses.

Prof. S. P. Sharples, of Boston, after an examination of many specimens of the oxide of antimony received from me, has made the following statement:—"The mineral varies in colour from almost white to a very dark brown. The specific gravity of one of the purest specimens is 5.07; and it contained 5 per cent. of water, and 75 per cent. of antimony. This composition and specific gravity approach very closely the same for *stibiconite*.

"The mineral is only very slightly soluble in hydrochloric or nitric acid, or aqua regia. Fusion with bisulphate of soda only partially resolves it. It is, however, readily and easily decomposed in a platinum crucible with carbonate of soda.

"This oxide of antimony has hitherto been found only as a slight coating on other antimony minerals; and it has been difficult to get specimens of it even a few grains in weight.

"The mineral is not easily reduced before the blowpipe, but is very easily reduced in a crucible with powdered charcoal or cyanide of potassium, giving at a single operation buttons of star antimony."—*American Journal of Science*, November 1880.

ON THE THERMOELECTRIC POWER OF IRON AND PLATINUM IN VACUO. BY PROF. C. A. YOUNG, OF PRINCETON, N. J.

Exner, a few months ago, published a paper asserting that the

thermoelectric power of antimony and bismuth is destroyed by removing them from all contact with oxygen and immersing them in an atmosphere of pure nitrogen. From this he argues that the thermoelectric force in general is due to the contact of the gases which bathe the metals. The following experiment was tried to test the theory:—

By the kindness of Mr. Edison and Mr. Upton a vacuum-tube was prepared in Mr. Edison's laboratory, containing an iron wire, about two inches long, firmly joined to two platinum terminals which passed through the walls of the tube. The tube was exhausted until the spark from a two-inch induction-coil would not pass $\frac{1}{8}$ of an inch in the gauge-tube, indicating a residual atmosphere of about one-millionth. The wire was heated to incandescence during the exhaustion, in order to drive off any possible occluded gases. The platinum wires outside the tubes were joined to iron wires, the joinings being covered by glass tubes slipped over them; and a sensitive reflecting galvanometer was included in the circuit. By laying the tube and connected joinings in the sunshine, and alternately shading one or several of the joinings, it was found that the electromotive power of the joinings within the tube was precisely the same as that of those without, and the development of current just as rapid. There was no trace of any modification due to the exhaustion.—*American Journal of Science*, November 1880.

ON INDUCTION IN ROTATING SPHERES. BY H. HERTZ*.

The reciprocal actions between magnets and rotating masses of metals, discovered by Arago, were first apprehended by Faraday as phenomena of electrodynamic attraction, and traced to currents which are induced in the masses by the magnets.

In the present work the problem, to determine these currents from the mathematical theory, is solved for the case that the body considered is a solid or a hollow sphere rotating about a diameter. The inducing magnets can be situated in the external or, with hollow spheres, in the internal space. The solution is also extended to the case in which the mass of the sphere is capable of assuming magnetic polarity. The principal results are collected in the following summary; for the workings I must refer the reader to the original.

As in the sphere electrical motions can be superposed, the inducing-potential function is resolved according to spherical functions, and a term of the evolution of the form $A\rho^n \cos i \omega P_m(\theta)$ considered. For the induction produced by such a term the following propositions were demonstrated:—

The flow always takes place in concentric spherical shells around the zero point. The current-function of each spherical layer is a spherical function of the same kind as the inducing; the current-curves have therefore the same form as the level-curves of the inducing potential; but they appear rotated towards them a certain

* Inaugural Dissertation: Berlin, 1880. 93 pp. Abstract by the Author.