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I have made experiments on several different specimens, and the results vary little from each other. The range of temperature with which the experiments were made was from zero to 43° C., on a bar 25 mm. in diameter, and 304 mm. long, this expanding in length 9–10 mm.; making the entire expansion equal to $\frac{1}{126}$ of the entire length of the rod for a temperature ranging from freezing to boiling point, giving as coefficient for linear expansion for one degree centigrade 0·000079365. This coefficient is seen to be lower than that of mercury; but from the fact that mercury corrects the pendulum by only one-half its expansion, and the vulcanite is made to correct it by its entire expansion, the length of vulcanite required is even less than the column of mercury used in the mercurial pendulum. This instrument is one whose use depends on its accuracy of operation after careful trial for some time.

ART. XIII.—*Aragonite on the surface of a meteoric iron, and a new mineral (Daubréelite) in the concretions of the interior of the same;* by J. LAWRENCE SMITH, Louisville, Ky.

I. *Incrustation of Aragonite.*

THE remarks in this communication have reference to some of the masses of iron that have been brought from that region of Mexico called the *Bolson de Mapini*, or the Mexican desert, situated in Cohahuila and Chihuahua, two of the northern provinces of Mexico; the desert being four hundred miles from east to west, and five hundred miles from north to south, bordering on the Rio Grande. This region, so prolific in masses of meteoric iron, has been described by Prof. Burckhardt of Bonn as well as by myself.

In 1854 I described three of the masses (this Journal, vol. xxviii, pp. 409); two of these have been brought to the United States, one weighing 125 kilograms and the other 630 kilograms. In 1868, eight others were brought to this country, the heaviest weighing 325 kilograms. These I described in 1869 (this Journ., Nov., 1869); and in 1871 I was enabled to give a description and an analysis of a still larger one weighing about 3500 kilograms, this last one remaining on the western boundary of the desert near El Para.

We have some account of one even larger than the last, located in the very center of the desert. So far as known there have been found in this locality not less than 15,000 kilograms of meteoric matter, an amount exceeding that which has been brought together in cabinets from all other sources.

When I examined the eight masses in 1868, I noticed a white crust on a small part of the surfaces of two of them, but at that time I could not make any critical examination of it. Within the past few months, these irons have come under my control, and therefore I have been enabled to examine the points that had been omitted, the most interesting of which forms the subject of this communication.

On one of these masses of iron, weighing 210 kilograms, there is a small amount of a white incrustation covering about 15 square centimeters of the surface: and on another, weighing 275 kilograms, there is an incrustation, which covered originally over 200 square centimeters of the surface, attached firmly to the iron, and when broken off (as most of it has been by careless handling of the mass), it brings away with it on the under surface a portion of the iron that has become oxidized: its thickness is from one to five millimeters.

It is quite hard, scratching calc spar very readily; the surface of it is irregular and granular. If broken perpendicularly to the surface of the iron and ground down, it will receive a very good polish, showing an irregular and wavy structure on many of the pieces, and parallel to the surface of the iron, with yellow and dark brown streaks like the Gibraltar limerock; it effervesces with acids, and is an incrustation of aragonite.

The following is the composition of the mineral:

Carbonate of lime	93·10
Sesquioxide of iron	1·00
Magnesia	*trace*
Insoluble residue	4·60
Water	1·00

As regards its formation, I am satisfied that the crust has been made on the iron since the fall of the latter. Conceiving this to be the case, I desired to know the nature of the rock and soil where these meteorites were found, and I have been able to gather the following particulars from Dr. Butcher who collected the specimens under examination. This spot is in an alluvial valley or plain between two ranges of high mountains running parallel with each other varying in distance from one to three miles. The mountains at the base are calcareous in formation, and in the hills and plains there are large calcareous deposits. The plain in many places is cut up with deep ravines, and several of the specimens of iron were found among the stones and sand at the bottom of the ravines, and during heavy rains were washed or covered with water. It is however only in wet seasons that the water is found remaining in the ravines and depressions of the valley, and this water is always brackish to the taste, containing a large amount of mineral matter.

Without giving any further details of the nature of this region of Mexico where these meteorites were collected, sufficient has been stated to show the probable source of the calcareous incrustation which I discovered upon two of them.

This incrustation on meteorites has been discovered but twice before, and in both instances by myself. One of them, however, is of so obscure and unsatisfactory a character that I have not given any public notice of it. The other is the case of the Newton County meteorite described by me (this Journal, II, vol. xl, 1865). It is a meteoric stone belonging to the variety classified by M. Daubrée as Syssidères; specimens of it have been furnished by me to the museums of the Garden of Plants, Great Britain and Vienna, with this incrustation in well defined particles of a translucent character adhering firmly to the surface. The entire amount of this meteorite yet known does not exceed 700 grams, although the primitive mass must still exist in a sparsely settled region of Arkansas, and when obtained will no doubt furnish specimens with a larger amount of the calcareous incrustation upon it.

2. *New Meteoric Mineral, Daubréelite.*

Two of the masses of iron above referred to have been cut across, the section made on one of them being over fifteen square decimeters; also several transverse cuts have been made. In all of these sections a number of nodular concretions have been exposed, most of them quite small, and hardly any exceeding a centimeter in diameter. At the first glance all these nodules have the appearance of very finely crystallized troilite; but a little closer inspection reveals the fact that most of these nodules have more or less of a black mineral associated with it. I had never seen anything of the kind before, it being very evident that it was not graphite. As further examination has proved it to be a new and interesting mineral, I have thought proper to designate it after M. Daubrée, who has done so much in the study and elucidation of meteoric minerals.

Daubréelite is a black lustrous mineral, highly crystalline in structure, occurring on the borders of the troilite nodules, and sometimes running across the center of them, as may be seen in one of the specimens, where, in a nodule of troilite, a vein of the mineral traverses the very center of the nodule, which is two millimeters in width and twelve millimeters long. It has a distinct cleavage, but I cannot make out its crystalline form. It is very fragile, and in the attempt to detach it from the iron, it breaks up into small fragments resembling small particles of molybdenite. It is feebly attracted in very fine particles when a strong magnet is brought in contact with it. This may arise from the presence of a minute quantity of troilite which it is very difficult to get rid of. Pulverized, it furnishes a perfectly black powder, the smallest particle of which gives before the blowpipe a very strong reaction of chromium. Heated very intensely, it loses its brilliant color and becomes a dull black.

The powdered mineral is dissolved completely in nitric acid. The solution is intensely green, and furnishes a strong reaction of sulphuric acid and oxide of chrome. The other strong acids attack it but slightly.

This solubility in nitric acid readily distinguishes it from chrome iron. The quantity of mineral I was enabled to obtain pure, or nearly so, was very small, the reaction of the acids on the mineral being nearly the same as on troilite. I am enabled to separate them only by varying the strength of the acids, and the length of the time they are in contact with the minerals.

Less than one hundred milligrams were obtained of sufficient purity to make out its composition, and this amount furnished me 36·48 per cent of sulphur; the remainder was chrome with nearly ten per cent of iron, and a little carbonaceous matter. This mineral when obtained pure and in sufficient quantity for a thorough analysis (which I hope to make before long), will, I am satisfied, prove to be a protosulphide of chrome. The iron present being mixed with the Daubréelite. The following therefore would express its true composition: Sulphur 37·62, chrome 62·38.

This mineral is an interesting one, and is found in a very strange place, yet from what is revealed to us by the spectroscope with regard to the vapors surrounding the sun, the element chrome must be widely diffused in the matter of the universe.

ART. XIV.—*On some of the changes in the Physical Properties of Steel, produced by Tempering*; by A. S. KIMBALL, Prof. of Physics in the Worcester Institute of Industrial Science.

A FEW interesting, and, to a certain extent, novel results have recently been developed in our laboratory, which I venture to present in their present incomplete form, since the pressure of other duties will postpone, for a few months, further investigations in this direction. Up to the present time the larger number of our experiments have been made upon the behavior of tempered bars under a transverse stress, although a few qualitative trials have been made upon changes in electric conductivity and coefficients of expansion.

I. *The modulus of elasticity decreases as the hardness of the steel increases; in other words the harder the bar, the greater the deflection produced by a given weight.*