CHEMISTRY

Some Elements Yielded by Yttrium

"A Classic of Science"

How One New Earth After Another Appeared as Chemists Purified Rare Minerals From the Mines of Ytterby

These extracts show the long process of trial and error by which the rare earths were worked out. The elements derived from Yttrium as now accepted are Gadolinium, Terbium, Dysprosium, Holmium, Erbium, Thulium, Ytterbium and Lutecium.

ON YTTERBINE, a New Earth Contained in Gadolinite. Note by M. C. Marignac. In COMPTES RENDUS, Tome 87, Paris, 1878.

AS A RESULT of the researches which I have made upon the earths from gadolinite, researches which had for their object and which have for their result the confirmation of observations by M. Delafontaine upon the existence of terbine and of a new base belonging to the same group, to which he gave the name *philippine,* I have obtained a few grams of an earth presenting all the characteristics which belong to erbine, following the classic work of MM. Bahr and Bunsen and of MM. Cleve and Hoglund.

Process Unlike Others

I ought to state, however, that the process by which I separated it from the other earths of gadolinite is not absolutely identical with that which those chemists used Bunsen's process consists of heating the mixed nitrates until red vapor appears, redissolving in boiling water and separating out the nitrite rich in erbine which precipitates in small needle-shaped crystals upon cooling the solution. As for me, I was able to carry the decomposition of the nitrates much further, up to the moment that the mass became sticky. Upon treating the mass with boiling water, there remains an insoluble residue in which the erbine is concentrated. By one or the other of these processes, repeated a very great number of times, we end by obtaining an earth of a pure rose color, which is erbine.

In my first researches, I stopped the treatment as soon as I arrived at a rose colored earth whose equivalent weight, lying between 128 and 129, corresponded to that which has been assigned to erbine.

More recently, I have again taken up the products thus obtained, as I wished to assure myself whether, by continuing these same operations, I should obtain any further increase in the equivalent weight. Instead, I observed a fact which surprised me very much.

Whereas, in the first part of my work, the gradual increase of the equivalent weight corresponds to a deepening in intensity of the rose color and of the absorption bands characteristic of erbine, there came a time when, the equivalent weight continuing to increase slowly, the rose color and the absorption lines diminished quite rapidly, so much so that the last product obtained was perfectly white, its salts colorless, and no longer giving the absorption lines.

The last three products obtained gave the equivalent weights 130.4, 130.6 and 130.8. The first two still showed a sensible rose color, especially in the oxalate and sulphate crystals. The number 131 can be set approximately as the limit of equivalent weight which may be reached, if one can operate upon a sufficient quantity of material to carry this method of purification far enough.

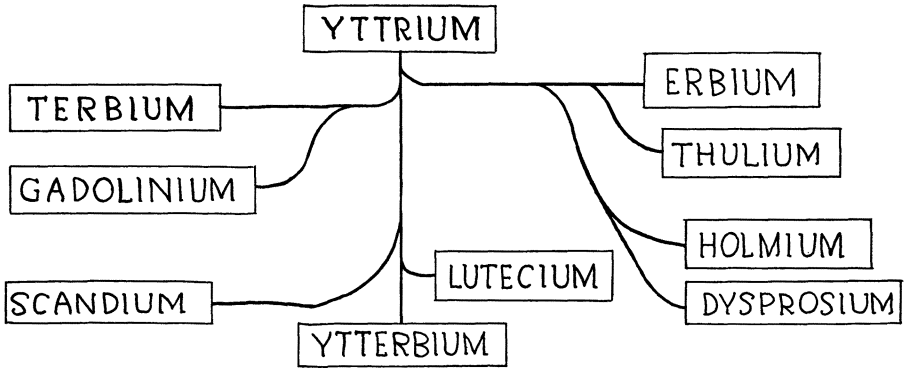
It is evident from this that the earth which I extracted from gadolinite, and which I believed to be erbine, was only a mixture of two distinct oxides. One, a pure rose color presenting a very characteristic absorption spectrum, ought to keep the name *erbine,* since these are the characteristics which have been considered as more distinctive of that base. The other is a new base, belonging to the same group, and for it I propose the name *ytterbine,* which will recall its presence in the mineral from Ytterby, and its similarity to yttria, on the one hand, by its lack of color, to erbine, on the other by the magnitude of its equivalent weight, with both of them by the whole of its properties. . . .

ON TWO NEW ELEMENTS IN ERBINE. Note by M. P.-T. Cleve. In COMPTES RENDUS, Tome 89, Paris, 1879.

Toward the end of last year, M. Marignac discovered in erbine, till then considered an oxide of a single metal erbium, the oxide of a new metal, ytterbine, very strongly characterized. A short time afterward, M. Nilson found in erbine another oxide, scandine, whose salts are colorless like those of ytterbine. The substance which gives to the salts of erbine the red color and their beautiful absorption spectra, that is to say, the true erbine, is still unknown. I proposed to extract from the old erbine its coloring principle. I had at my disposal a considerable quantity of material almost entirely free from ytterbine; M. Nilson very kindly gave me his precious residues from the extraction of scandine and ytterbine: nevertheless I found it absolutely impossible to obtain a red oxide of constant molecular weight, even after hundreds of decompositions.

Another New Oxide

I have been driven, since then, to postulate the presence of still another unknown new oxide, so I asked M. Thalen to examine the absorption spectrum of the fraction which I regard as most pure in erbine, and at the same time to compare that spectrum with spectra of residues rich in ytterbine and yttria. Some absorption bands in the last fractions suggested the idea that the color of erbine is due to the presence of three oxides in the absorption spectra. I therefore combined the redder fractions, of molecular weight 126 to 127 (RO), and submitted them to a long series of decompositions, treating one fraction (A) for ytterbine, another (B) for yttria, and a third intermediate between them in



THE FAMILY TREE OF YTTRIUM'S DESCENDANTS

This diagram shows the way chemists isolated the new earths from the Swedish rare mineral, gadolinite.

which the true erbine ought to become concentrated. At the same time, I tried to concentrate the coloring matter in the residues rich in ytterbine (A) and in yttria (B). When I had pushed the decompositions until obliged to stop for lack of material, I sent the five fractions for examination by M. Thalen, who had the kindness to study them with great care. . . .

We see then that the (absorption) band *x* pertains to fractions situated near ytterbine, and that it does not exist in the fractions which derive from yttrium. But it is just the opposite with bands *y* and *z;* in fact, these bands, which lack everything found in the residues of ytterbine, appear more and more pure, in proportion as they approach yttrium.

It appears from these researches that the spectrum of the old erbine ought to be attributed to three distinct oxides. In fact, the color of the solutions of the diverse fractions is sensibly different. Thus the fractions treated for ytterbine are colored rose with a tint of violet, the fractions treated for yttria have an orange tint. Although I have a considerable quantity of the mixture of these three oxides, I am convinced that it will be useless to continue these researches until I am able to get still more.

Proposes a Name

As for the radical of the oxide occurring between ytterbine and erbine, which is characterized by the band *x* in the red part of the spectrum, I propose the name thulium, derived from Thule, the earliest name of Scandinavia. The atomic weight of the metal Tm ought to be about 113 (its oxide being RO) ; at least, its oxide is concentrated in the fractions which have the molecular weight 129.

The true erbium, to which the common bands should be attributed, probably has an atomic weight of 110 to 111. Its oxide is of a clear rose color.

The third metal, characterized by the bands *y* and *z,* which is found between erbine and terbine, ought to have an atomic weight lower than 108. Its oxide appears to be yellow; at least, all the fractions of molecular weight lower than 126 are more or less yellow. I propose for this metal the name of holmium, Ho, derived from the latinized name of Stockholm, in whose vicinity occur so many minerals rich in yttria.

It remains to tender M. Thalen my lively appreciation of the trouble which he has taken with all these researches.

Science News Letter, July 11, 1931

ZOOLOGY

Drinking Troughs Preserve Rare African Elephants

BOREHOLES have been sunk, and special drinking troughs have been provided, to secure protection for a herd of some forty South African elephants in the Addo Reserve in South Africa. These forty represent the last of a species which are somewhat smaller than their northern brothers in Africa. The absence of water caused these elephants to roam off the reserve, doing damage to neighboring farms.

Another huge preserve is being established between the Aub and the Nosob rivers in the Northwestern Cape Province, and here the gemsbuck, one of the most beautiful of South African antelopes, will be preserved. This animal is very nearly extinct in other parts of the South African Union.

A third reserve will be in the Bredasdrop district, where the spotted deer, only ninety of which are left, will be protected. Twenty-five of these animals will be fenced in, and every effort made to encourage their increase. It is proposed to place these new reserves under the National Parks Board of South Africa, which now administers the Kruger National Park.

Science News Letter, July 11, 1931

MEDICINE

New Studies Cast Doubt on Cancer Treatment Value

FURTHER DOUBT on the value of the Coffey-Humber treatment for cancer is cast by a report made by Dr. Howard A. Ball of Los Angeles to the *American Journal of Cancer.*

Dr. Ball examined the tissues of the cancers or other malignant growths on the bodies of patients who had had the Coffey-Humber treatment with suprarenal cortex extract. He compared these with the cancers of patients who had died without having had the Coffey-Humber treatment. There was no evidence that the treatment had had any effect on the cancer.

"No essential change from that usually observed in the characteristics of malignant tissue in far advanced cases could be determined in a series of 89 cases that received the experimental suprarenal cortex extract (Coffey-Humber)," he reported.

He also found that the cancer had spread to the suprarenal glands in a strikingly large number of cases of the group that had had the Coffey-Humber treatment. This is all the more significant since Coffey and Humber hold the theory that these very glands produce a principle governing cell growth, and base their treatment on this theory. It would seem that such an organ which had the power of regulating cell growth, if it existed, would be least prone to cancer in the first place and the least frequent place for secondary cancers to develop, Dr. Ball commented.

Dr. Ball made his investigation while research pathologist for the W. K. Kellogg Foundation of California.

Science News Letter, July 11, 1931