

EFFECT OF THE CATHODE RAYS IN CHANGING THE
COLORS OF CERTAIN MINERALS.

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SOME twelve years since it was observed that if green or colorless fluorite were subjected to the action of the cathode ray in a vacuum, the color of the mineral was changed. The matter has been somewhat farther investigated with the following results.

A straight glass tube about 15 cm. long and 2 cm. in diameter is furnished with a flat disc electrode at either end and midway with an aluminum shelf. A side tube with ground-in joint serves to introduce and remove the specimens, which rest upon the shelf, opposite the cathode.

A high vacuum being produced in the tube the minerals are bombarded in the cathode stream. The current is kept low so as not to unduly heat the tube or minerals.

FLUORITE.

The most common varieties of this mineral are colorless, green and amethyst. By the action of the cathode ray the colorless and green are quickly changed to the amethyst variety.

If the vacuum be high and the current weak the change penetrates deeply into the mineral. With a lower vacuum or stronger current the penetration is not as deep but the surface coloration more intense, at length becoming bronzed, and looking exactly as though a solution of violet aniline had been allowed to dry upon the surface of the mineral. In the latter case the surface being ground or chipped away, the unchanged mineral is found below. It is interesting to note that at all stages the color produced by the cathode ray is indistinguishable from that of the native mineral, differing only in intensity.

TOURMALINE.

Tourmalines from Paris, Maine, and a few neighboring localities are commonly pink or green in color; the two colors not infre-

quently being united in the same crystal. In this case the crystal may shade from nearly colorless at one end through various tints of pink into light and dark green at the other end. A crystal pale pink in color was broken in two; one piece kept for comparison, and the other treated in the vacuum tube for twenty minutes. At the end of that time the pink tint of the treated fragment had changed to the characteristic tourmaline-green. The crystal was not very transparent, but the change seemed to be complete throughout, so that further treatment produced no further visible change. The change was not the effect of heat; for when the untreated half was heated for half an hour no change was produced in it. Both parts were boiled together in nitric acid, washed and dried, without producing alteration in either.

CORUNDUM.

A semi-transparent crystal of this mineral was broken into three pieces. One piece was kept for comparison, the second was treated for five minutes and the third for twenty minutes.

The original color of the specimen was not uniform, being bluish in spots and in others reddish—the general effect being light purple. The change in tint even in the piece receiving the shorter treatment was unmistakable; so that the three pieces being placed in the hand of a person who knew nothing about the matter, he instantly distinguished among them, pronouncing the longest treated piece the palest of the three.

The imperfect transparency of the specimen does not permit much more to be added. No change was produced by subsequent heating and boiling in nitric acid.

When the color of a mineral depends upon some chemical admixture the fact is often revealed by its fluorescence; which at the same time is a very delicate test of such admixture. For instance: fragments of green and flesh-colored apatite were treated together in the tube; the green fluoresced green and the flesh-colored red, but the color of neither was changed by the treatment.

Again: a bit of perfectly transparent and nearly colorless cyanite fluoresced yellow, and with remarkable brilliancy surpassing willemite even. A piece only 0.5 sq. cm. in area gave sufficient light

to enable the reading of a watch nearly a meter distant. On the other hand the ordinary blue cyanite fluoresces red, almost exactly like corundum.

The action of the cathode ray in affecting mineral coloration brings to mind the recently discovered action of radium emanation upon the corundum minerals, and strongly suggests that some minerals have been changed while in the earth by radio-activity.

The fact that fluorite is often found in alternate crystalized bands of colorless and amethyst, and that the tourmaline is bi-colored, may be in some way connected with the pyro-electric properties of the minerals — known to be particularly marked in tourmaline. I have left a small heap of moderately active radium on a transparent fluorite plate for eight months but no visible change has yet been produced. The same radium has colored pink the glass tube in which it is kept. One may not infrequently find fragments of glass, originally white, changed to the same color that radium imparts to glass, by merely lying long exposed in contact with the earth. I am told that in our southwestern deserts the change is effected with comparative rapidity.

I now publish the above notes in the hope that some one having better and more extensive material than is at my command may take up and pursue the matter.

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