

CLXXIV.—*The Direct Action of Radium on Copper and Gold.*

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IN view of the observation of Sir William Ramsay, that lithium appears when the emanation of radium is allowed to act on a pure copper salt, I thought it would be interesting and instructive to try the effect on a copper salt of the direct action of radium. For this purpose, 5 milligrams of radium barium bromide, containing 2 milligrams of radium bromide, were dissolved in a few drops of water and evaporated to dryness in a capsule of silica ware 1.7 cm. deep and 1.3 cm. in diameter. The radium salt thus formed a layer at the bottom of the capsule. About 0.5 gram of pure copper nitrate was dissolved, and treated in the same way in another capsule of the same size; the capsules were placed facing, and in contact with, one another in a wide glass tube, which was then drawn off, exhausted to about 0.1 mm., and sealed. In this way it was thought that the greatest possible effect of the radium radiations would be obtained. The great activity of the radium emanation is caused presumably by the rapidity with which it throws out α -rays; but this activity decays rapidly, so that by the direct action of radium and the stored up

emanation a more economical use of the energy is made. The copper nitrate was made by passing oxides of nitrogen (from copper and nitric acid) through a silica tube into a silica flask containing water and some electrolytic copper foil. The water was specially distilled and kept from contact with glass.

The copper nitrate prepared in this way was tested spectroscopically after precipitating the copper with hydrogen sulphide and evaporating to a very small bulk; traces of potassium and sodium were found, but no lithium. It was tested also by igniting in a platinum basin and extracting with water; the result was the same.

The radium and the copper were left together for three months, when the tube was opened and the copper nitrate tested by the method just described; no lithium was found.

In another experiment, 5 milligrams of radium bromide of strength 1,800,000 were allowed to act on copper sulphate in a similar way for four months. The copper salt was prepared by repeatedly crystallising the best quality commercial copper sulphate; it could not be freed completely from potassium and sodium even when crystallised in silica vessels, but no lithium could be found. After the action of the radium, the spectroscopic examination gave the same result.

It may be objected that the quantity of radium employed in these experiments was too small. It must, however, be remembered that 0.000,001 milligram of lithium can be detected with the spectro-scope, and this was confirmed with the instrument used, a direct vision Hilger. Consequently, we can say from the second experiment that radium bromide will not convert the one-hundred millionth part of its weight of copper into lithium per day when acting under the most favourable circumstances. (This is allowing 0.000,006 milligram of lithium as the smallest detectable quantity.)

The Direct Action of Radium on Gold.—Assuming that the copper atom is broken down by the radium emanation, it was thought that the atom of gold would be still more likely to suffer disintegration. This was first tried in solution. One gram of gold chloride was dissolved in 5 c.c. of water in a weighing bottle, and 1 gram of radium barium bromide containing 1 per cent. of radium bromide was added to the same solution, which was allowed to stand for four months. The gold was then precipitated together with the radium and barium by the addition of sulphurous acid; the mixture was filtered off, and the filtrate evaporated down and tested spectroscopically. The sodium line was very strong; there were traces also of potassium and calcium, but no lithium could be found.

The precipitate on the filter paper, consisting of radium barium sulphate and of metallic gold, was very thoroughly washed and allowed to stand, protected from dust, for three months. It was then

washed and the washings tested again; nothing was found but a trace of sodium. After standing again for four months, it was treated in the same way, with the same result. From this experiment, it can be said that radium bromide (under the conditions of the experiment) will not convert the one two-hundred millionth part of its weight of gold into lithium per day.

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