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RADIOACTIVE ISOTOPES OF BARIUM

Richard W. Fink and D. H. Templeton

April 21, 1950

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RADIOACTIVE ISOTOPES OF BARIUM*

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April 21, 1950

In this letter we report the results of some preliminary experiments concerning neutron deficient isotopes of barium.

Spectroscopically pure CsCl was bombarded with 85-Mev protons in the 184-inch Berkeley cyclotron for periods of one to three hours. The induced barium radioactivities, after chemical isolation, were observed with a Geiger counter with a 3 mg/cm^2 mica window. The decay curve showed half-lives of 2.0 $\pm$ 0.1 hours and 2.4 $\pm$ 0.1 days, as well as longer-lived activity due to the well known[1] Ba^{131} and its daughter Cs^{131}.

Isolation of cesium from the purified barium (after the 2.0-hour activity had effectively decayed) yielded[2] a mixture of 31-hour Cs^{129} and 10-day Cs^{131}. Subsequent separations of cesium from the same barium yielded only Cs^{131}, at a time when the 2.4-day activity was still present. Thus it is probable that the 2.0-hour activity is Ba^{129} produced by the reaction $Cs^{133}(p,5n)$. The 2.4-day period is not Ba^{127}, otherwise it would produce 5.5-hour Cs^{127} as a daughter. The most probable assignment is Ba^{128} from the (p,6n) reaction, but this assignment lacks direct proof.

A mass-spectrographic analysis of a purified barium fraction showed a line at mass 129 which was proved to be radioactive by the transfer plate technique. A second line at mass 128 was too weak to be identified as radioactive. The line at 129 is probably due to the cesium daughter, which had time to grow between the purification and the analysis. Cesium is ionized with the thermal ion source with much greater efficiency than is barium. The mass scale was fixed by means of a small amount of stable Cs^{133} added to the sample.

Ba^{128} decays to Cs^{128}, which is expected to be short-lived[2] and to decay to stable Xe^{128}. Our experiments indicate a half-life of 30 minutes or less. Thus the radiations we observe for the 2.4-day period include those from both the barium decay and the cesium decay. We have observed positrons of energy limit about 3 Mev, electrons of about 0.3 Mev, and gamma-rays.

Ba^{129} emits positrons, but we have not characterized its radiations otherwise.

We have learned that E. O. Wiig and C. C. Thomas of the University of Rochester have reached some of these same conclusions independently.[3]

We are indebted to the crew of the 184-inch cyclotron for their cooperation in these experiments, and to F. L. Reynolds for assistance with the mass spectrograph.

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*This work was performed under the auspices of the U. S. Atomic Energy Commission.

†Now at the Knolls Atomic Power Laboratory, Schenectady, New York.

[1]G. T. Seaborg and I. Perlman, Rev. Mod. Phys. 20, 585 (1948).

[2]Fink, Reynolds, and Templeton, Phys. Rev. 77, 614 (1950).

[3]Thomas, private communication.