Results of Atmosphere Analyses Done at Tulsa, Oklahoma, During the Period Neighboring the Time of the Second Bikini Atomic Bomb Test

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RADIOACTIVE concentrates were prepared from the atmosphere by means to be described fully elsewhere, and subjected to inspection by means of various radioactive and chemical tests. The scope and thoroughness of the investigation was limited by lack of appropriate preparation, since it was not expected that any positive results at all would be obtained.

Concentrates were obtained from the atmosphere in sufficient strengths to enable definite indications to be had as to the nature of the substances recovered; chiefly by determination of the radioactive decay constants of the bodies studied. Five tests of the decay constants were performed, only three of which were thorough enough to elicit firm confidence. Of these three, one was based on beta-ray measurements alone, one was based on the concurrent use of beta-ray and alpha-ray measurement techniques, and the last was based on alpha-ray work only, the activity being too weak to permit beta-ray determinations. These three sets of data were obtained on July 26, July 28, and August 30, respectively. The data of July 26 and August 30 can be explained by saying that the substances obtained on these occasions were the active deposits of radon and of thoron; the data of July 28 cannot be so explained, and, apparently, correspond with a substance or substances unknown to us (see Fig. 1).

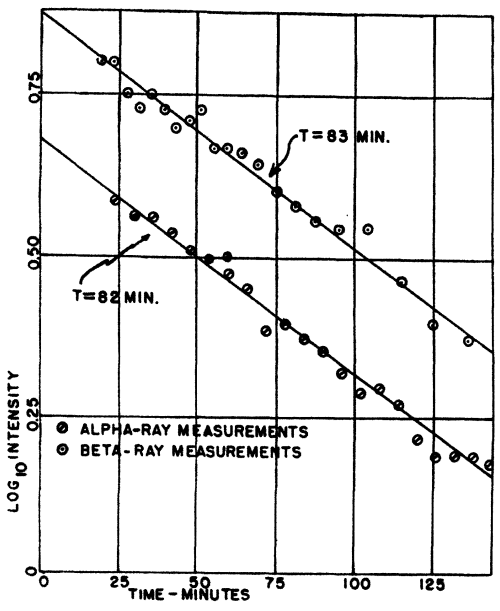

FIG. 1. Concurrent measurements of radioactivity made on two substantially identical atmosphere concentrate samples procured at Tulsa, Oklahoma on July 28, 1946, and having an initial intensity of approximately 5×10^{-10} curie.

A long-lived body was tentatively identified as lead, by co-precipitation methods. This was probably the active deposit of thoron, but further work must be done to make sure.

Our conclusions are:

(1) It seems plausible to explain the data of July 28 by assuming that the concentrate obtained by us is the active deposit of a new rare radioactive gas of atomic number 86, having an effective half-life of 82 minutes, and corresponding with at least two members of an unreported radioactive series.

(2) No general correlation of the total radioactive intensity with the explosion of the bomb was obtained, although our method of concentration was not well adapted to produce such a correlation, and it may be that a more suitable method would have.

The Ionization of the Atmosphere in the New York Area Before and After the Bikini Atom Bomb Test

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SINCE Herzog[1] reported a very marked increase of gamma-radiation from the air following the atomic bomb test at Bikini on July 1, 1946, it may be of interest to report some observations made in New York between June 29 and July 10. Herzog's measurements were made at Houston, Texas with a self-recording gamma-ray counter. It was not stated whether this apparatus was screened from below or on the sides.

We used an ionization meter devised by O. H. Gish and one of the authors[2] for field measurements. It consists of a cylindrical ionization chamber (volume 13 liters, filled with pure nitrogen at atmospheric pressure, brass walls, 2.5 mm thick) connected with a shielded Lindemann electrometer which is used here only as a null instrument. The readings are taken subjectively, in intervals of a few minutes, by means of a precision voltmeter which measures the compensating voltage necessary to bring the floating needle back to zero after known intervals of time.

The observations were taken on the flat roof of the Physics Building of Fordham University (140 ft. above sea level) near the Botanical Garden, New York.

Herzog observed an increase in the counting rate beginning on July 4, 8 P.M. (Houston time), and reaching a maximum of 77 percent above the normal counting rate on July 5, 3 A.M. The counting rate returned to normal 16 hours later.

Our observations were, naturally, not continuous, but

tests were made several times a day, for about one hour each time. A persistent increase of ionization extending over half a day or so could not have been missed.

The data observed at Fordham are given in Table I.

TABLE I. Total ionization on the roof of the Physics Building, Fordham University, New York, New York.

Time	Ionization	Time	Ionization
June 29 (mean)	6.28 I	July 7 11 A.M.	6.19 I
June 30 (mean)	6.07 I	July 7 8 P.M.	6.07 I
July 1 (mean)	6.07 I	July 8 8 A.M.	6.41 I
July 2 (mean)	6.32 I	July 8 10 A.M.	6.78 I
July 3 A.M.	5.96 I	July 8 11 A.M.	6.67 I
July 3 P.M.	6.08 I	July 8 noon	6.06 I
July 4 A.M.	6.26 I	July 8 1 P.M.	6.05 I
July 4 P.M.	5.93 I	July 8 7.30 P.M.	6.10 I
July 5 8 A.M.	5.95 I	July 9 8 A.M.	6.33 I
July 5 2 P.M.	6.20 I	July 9 3 P.M.	5.91 I
July 5 8 P.M.	6.47 I	July 10 10 A.M.	6.18 I
July 6 8 A.M.	6.24 I	July 10 8 P.M.	5.89 I
July 6 4 P.M.	6.00 I		

The total ionization I (in ion pairs produced per cc and sec. in pure nitrogen at N.P.T.) observed on the roof is, on the average, about 6 I, consisting of 2 I due to cosmic rays, 3 I local gamma-rays from the building, 0 to 0.5 I gamma-rays from the radioactive substances in the atmosphere and about 0.7 I residual ionization of the vessel itself.

The figures reported below are average values of from 30 to 60 min. continuous observation in each case. For the first few days mean values of the whole day are given.

Isolated higher values (as for instance on July 2 where a single value of 6.8 I was observed just for one hour) may be caused by cosmic-ray showers or bursts and are unimportant for judgment on any possible influence of the atom bomb cloud.

From the values shown in this table it is evident that no effect ascribable to the radioactive atom bomb cloud was noticed before July 8. On this date a slight increase of ionization (0.3 to 0.7 I) occurred and persisted for several hours. It is highly questionable, however, whether this effect was really produced by gamma-rays from the air, for two reasons: first, the general circulation in the United States, at levels of 7–12 km in the summer, is anticyclonic and in the eastern half of the country a northwesterly wind component would prohibit a radioactive air mass from reaching the New York area; second, from the weather maps (July 4 to July 8) the component wind velocity at 7 km, in the general direction from Houston to New York, was only 5 knots. Therefore the air mass present over Houston on July 5 would not have reached New York in much less than 200 hours. It is, of course, unfortunate that our observations were discontinued on July 10, but from the evidence presented here it is practically certain that no effects from the Bikini test were in evidence in the North Atlantic states, more than 7000 miles from the Bikini Islands.

We are indebted to Mr. Hormantas, Meteorological Office, LaGuardia Field for furnishing the meteorological data.

[1] G. Herzog, Phys. Rev. **70**, 227 (1946).
[2] See a forthcoming article of V. F. Hess, Trans. Am. Geophys. Union **27**, No. 5 (October, 1946).

Effort to Observe Anomalous Gamma-Rays Connected with Atomic Bomb Test of July 1, 1946

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A GAMMA-RAY anomaly associated with the atomic bomb test at Bikini Island on July 1, 1946, having been observed by Herzog[1] at Houston, Texas, on July 4 and 5, the absence of such an anomaly at College Station, 100 miles northwest of Houston, becomes a matter of interest.

Daily measurements of the background of stray radiation were made in a laboratory on the upper floor of a two-story brick building in College Station, during the following periods: June 25 to July 5; July 8 to 11; 16 to 19; and 23 to 26. The counting unit of an x-ray spectrometer which employs Geiger counter registration was used for the purpose. A rough indication of gamma-ray sensitivity was obtained by placing a four-ounce specimen of carnotite 15 inches from the longitudinal axis of the counter. This resulted in an increase of about 45 percent in the counting rate.

The observed background counting rates varied from 0.317 to 0.339 per sec., exceeding the average value of 0.329 by slightly more than the expected statistical fluctuation (0.0064 per sec.) on three dates, July 1, 2, and 18; but, even in these cases, the variations were too small to be regarded as significant.

Since the observations were all made at about the same time of day, it is unlikely that any local anomaly of as much as 24 hours duration occurred during the periods covered by the experiment. The observation of July 5 was concluded at 10:36 A.M., several hours after the maximum of the Houston anomaly but well before its expiration, and might have been expected to reveal the existence of this anomaly, had it been of regional extent.

[1] G. Herzog, Phys. Rev. **70**, 227 (1946).

Schwarzschild Interior Solution

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IN a recent paper,[1] Wyman gave an interesting discussion of the solution of the gravitational equations of general relativity for the case of a sphere of perfect fluid of constant density, using isotropic coordinates. He found that, for a given value of the density ρ, the mass m and the radius a were restricted by the conditions,

$$m \leqslant 0.4a, \quad a^2 \leqslant 0.27R^2, \tag{1}$$

with $R^2 = \frac{3}{8\pi\rho}$, instead of the conditions found for the Schwarzschild solution,[2]

$$m \leqslant 4a/9, \quad a^2 \leqslant 8R^2/9. \tag{2}$$