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Letters

Remarks on Paper by P. J. Drevinsky, J. T. Wasson, E. C. Couble, and N. A. Dimond, 'Be^7, P^{32}, P^{33}, and S^{35}: Stratospheric Concentrations and Artificial Production'

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In their recent paper *Drevinsky et al.* [1964] question the validity of our conclusion [*Bleichrodt,* 1962; *Bleichrodt and van Abkoude,* 1963] that Be^7 was produced artificially by the Soviet tests of nuclear weapons in the autumn of 1961. They suggest that the more or less linear relationship observed between the concentrations of Be^7 and Sr^{89} in the lower stratosphere might be the (fortuitous) result of sampling air originating at higher altitudes and latitudes which is expected to contain higher concentrations of both cosmic-ray-produced Be^7 and, shortly after nuclear tests in polar regions, higher concentrations of fission products.

Although the explanation of Drevinsky et al. cannot be disproved unequivocally, it should be considered very unlikely for the following reasons.

(1) During the second half of 1963 another samples taken 13 km over the Netherlands have been analyzed for Be^7 and Sr^{89}. The concentration of Sr^{89} in these samples was so small that any artificial Be^7 from the United States and Soviet tests in 1962 can probably be neglected. The average concentration of cosmic-ray-produced Be^7 at an altitude of 13 km over the Netherlands calculated from these 9 samples and the 33 samples taken before September 1961, which are given in Table 1 of *Bleichrodt and van Abkoude* [1963], is 10.2 dpm kg^{-1}, with a standard deviation of 3.6 dpm kg^{-1}. The highest value of the 42 samples was 19.1 dpm kg^{-1}. Therefore it seems reasonable to conclude that concentrations of natural Be^7 will seldom exceed a value of 20 dpm kg^{-1} at the sampling location. During the period September 25, 1961, to April 10, 1962, i.e. during and after the Soviet tests at Novaya Zemlya and before the United States detonations in 1962, 10 of the 25 samples analyzed showed a higher concentration, the highest value being 46 dpm kg^{-1} [*Bleichrodt,* 1962; *Bleichrodt and van Abkoude,* 1963]. Moreover, these high concentrations were accompanied by high concentrations of fission products.

(2) The *U. S. Weather Bureau* [1961, 1964*a*] has taken samples of radioactivity at 70°N during May and June 1960, November 1960, May and June 1961, and on April 5, 1962. The average concentration of Be^7 at altitudes of 15.2, 18.3, and approximately 19.5 km for the first three periods is shown in Table 1 together with the concentration at about the same altitudes on April 5, 1962. The concentrations in April 1962 are much higher than those observed before the Soviet series of explosions in 1961.

If for each altitude the difference between the data in the second and third columns is divided by the concentrations of Sr^{89} found in the samples of April 1962, the Be^7/Sr^{89} ratios given in the fourth column are obtained. The last column shows the same ratios after correcting for radioactive decay to November 1, 1961. These data compare favorably with the ratio of 0.038 on November 1, 1961, suggested earlier for artificial Be^7 and Sr^{89} from the Soviet explosions of 1961 [*Bleichrodt and van Abkoude,* 1963]. An altitude of 20 km was probably reached only by clouds from the most powerful explosions. This might explain the somewhat higher ratio of artificial Be^7 and Sr^{89} at this altitude, as it was reported [*U. S. Weather Bureau,* 1964*b*] that the fission to fusion ratio for the bomb of highest yield was relatively low (Be^7 is most

TABLE 1. Ratio of Artificial Be^7 and Sr^{89} at 70°N in the Stratosphere [*U. S. Weather Bureau*, 1961 and 1964*a*]

Altitude, km	Be^7, dpm kg^{-1}		Ratio of Artificial Be^7 and Sr^{89}	Ratio on Nov. 1, 1961
	April 1962*	Natural†		
15.2	30	15 ± 4	0.043	0.038
18.3	44	24 ± 6	0.046	0.041
19.5		30 ± 7	0.087	0.077
20.1	93			

* One sample at each altitude.
† Average of 9 samples with standard deviation.

likely a reaction product of Li; Sr^{89} is a fission product).

(3) The same procedure can be used to calculate the ratio of artificial Be^7 and Sr^{89} from data of project Star Dust [*Friend and Feely*, 1961; *Friend et al.*, 1962]. Only 9 samples taken at the end of 1961 in which the concentration of Sr^{89} was high enough (more than 200 dpm kg^{-1}) were analyzed for both Be^7 and Sr^{89}. The ratio of artificial Be^7 and Sr^{89} in these samples taken at altitudes between 16.5 and 21.5 km at about 30°N ranges from 0.017 to 0.058. Values for the two samples showing highest concentrations of Sr^{89}, and therefore probably the most accurate ones, are 0.040 and 0.033, respectively. These values are in good agreement with those mentioned above.

It is understandable that Drevinsky et al. did not detect artificial Be^7 in their samples, as the amount of artificial radioactivity sampled was too small. If ratios of 8 for Ba^{140}/Sr^{89} and of 0.038 for Be^7/Sr^{89} are assumed at the time of explosion, it can be calculated from their data that the concentration of artificial Be^7 in their sample of November 6, 1961, amounted to about 60%. All other samples contained less artificial Be^7.

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