is now assumed that $Y_{95} = Y_{140}$, the values for unfractionated composition can be determined from the intersections of the curves with the vertical line through the point at which $f_{95} = f_{140}$. An estimate of the validity of the assumption that $Y_{95} = Y_{140}$ can be obtained from values in Table 5, as calculated from the Katcoff compilation (*9*).

Prediction of future behavior. The correlations presented here may be useful in estimating fractionation behavior in future high-yield sea-water surface and coral-surface bursts. It is to be expected that fractionation behavior from lower-yield devices, and from high-yield devices detonated over other surfaces (for example, silicate), may differ significantly from that presented here. In the absence of specific information, however, the behavior presented here may prove to be a useful basis of approximation for planning purposes.

Table 5. Variation of mass-140/mass-95 yield for various conditions of neutron fission.

Fissioning nucleus	Neutron energy	Y_{140}/Y_{95}
U^{235}	Thermal	1.03
U^{233}	Thermal	1.02
Pu^{239}	Thermal	0.96
U^{238}	Fast	1.00
Th^{232}	Fast	0.94

Summary and Discussion

The empirical approach taken here to the problem of fractionation has led to a number of valuable correlations.

1) The composition of fractionated samples from high-yield surface bursts can be correlated logarithmically.

2) The slopes obtained for the various mass chains (except for molybdenum-99) are relatively insensitive to the environment and are empirically related to precursor volatility.

3) Zirconium-95, cerium-144, uranium-237, and neptunium-239 do not fractionate grossly from one another, nor does molybdenum-99 fractionate from these radionuclides when coral is in the environment; cesium-137 does not fractionate grossly from strontium-89. The fact that the slopes of the correlation curve for two radionuclides are identical within their respective margins of error cannot be interpreted as meaning that no fractionation was observed. Small degrees of fractionation between similarly behaving radionuclides are best tested by plotting the ratio of their f values against the fractionation index.

4) Even the data with the poorest fit fall wide of the correlation lines only by a factor of about 2.

5) In all cases except that of the deep-water surface burst, the cloud sample was found to be rich in strontium-89.

It is evident at this point that several pieces of information are lacking for the data presented here. First in importance is the effect of artifactitious fractionation. The extent to which this has contributed to the scatter of points about the correlation lines is undeterminable. Because of the relatively small number of points, any error in the data from the most highly fractionated sample for a given burst would severely affect the type of correlation preferred and the resulting slope.

The behavior of the deep-water surface burst is anomalous in a number of respects, and supporting information on such detonations is needed.

The conditions studied represent a small proportion of the many possible conditions. The findings will have to be viewed in the light of similar studies on many other types of bursts before any firm conclusions and reliable generalizations can be reached.

References and Notes

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4. I wish to acknowledge the excellent work of L. R. Bunney, who supervised the preparation and distribution of samples, coordinated the radiochemical analyses, and accumulated the fission-product results; of L. Wish, who performed the majority of U^{237} and Np^{239} analyses; of Miss E. M. Scadden, who made the Mo^{99} determinations; of J. Pascual, who made the Te^{132} determinations; of J. L. Mackin, P. O. Strom, and D. MacDonald, who performed the Sr^{89}, Sr^{90}, Cs^{137}, and Ce^{144} analyses; and of W. E. Thompson and P. D. LaRiviere, who obtained the La^{140} results. The comments of C. E. Adams have been most helpful in preparing this article.
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Jerome T. Syverton, Microbiologist

Jerome T. Syverton began an outstanding, active career in microbiology as an instructor in bacteriology at the University of North Dakota in 1928. Born in Courtenay, North Dakota, on 29 March 1907, he entered the University of North Dakota in 1923, obtaining an A.B. degree in 1927 and a B.S. degree in 1928. He graduated from Harvard University School of Medicine in 1931, and after an internship and assistant residency in medicine at Duke University Hospital in 1931–32, he became an assistant in pathology and bacteriology at the Rockefeller Institute for Medical Research. There he obtained basic knowledge in virology under the guidance of P. K. Olitsky, and in 1932 he became a member of the faculty of the University of Rochester School of Medicine and Dentistry. He remained at Rochester until 1947, except for a sabbatical leave in 1942 at Vanderbilt University School of Medicine, as visiting associate professor of pathology and bacteriology.

Syverton's development of outstanding skill as a teacher and student adviser and his fundamental and pioneering work, involving, for example, tumor viruses and multiple viral infections of single animal cells, occurred during the period 1934–47, while he was in the department of bacteriology at the University of Rochester. For his outstanding research in virology he received the Lilly award in bacteriology

and immunology in 1938. From 1944 to 1946 he was on active duty in the United States Navy, first as a visiting investigator at the Rockefeller Institute, then as a member of Naval Medical Research Unit 2 in the Pacific Theater. In 1947 he became professor and head of the department of microbiology at Louisiana State University School of Medicine, and from 1948 until his death on 28 January 1961, he was professor and head of the department of bacteriology at the University of Minnesota.

During his academic career his enthusiastic and vigorous approach to professional life, with simultaneous devotion to his family and friends, set an extraordinary example for students and associates. His graduate and postdoctoral students during his 12 years at the University of Minnesota alone numbered over 65. To quote Richard E. Shope of the Rockefeller Institute, "One of the very nicest things that I know about Dr. Syverton was the generosity with which he shared his scientific ideas, and their exploitation, with others, usually graduate students or younger assistants in his department. He published almost none of his most significant observations alone and, where he shared in the publication with others, his name was almost never in the senior author position" (*1*).

Syverton's productivity as an investigator was remarkable, and during 1957–58 he was the recipient of the Commonwealth Fund award for creative work. Eighty-seven articles describing his own work and 119 describing work done in conjunction with his students and associates were published between 1933 and 1960. In the words of Shope, "Dr. Syverton was a prolific worker in the field of virology and his interests ranged widely. He worked first at the Rockefeller Institute on the viruses of vesicular stomatitis and equine encephalomyelitis, sharing in pioneer work with these agents. Later at Rochester, he

Jerome T. Syverton. [Zintsmaster's]

initiated work with the rabbit papilloma, and his continuing studies of the papilloma-to-carcinoma sequence in this virus-induced tumor contributed materially to our understanding of the progression through which a benign tumor cell acquires malignant properties. It was at Rochester too that, with Berry, he did his fundamental work dealing with multiple viral infections of single host cells, showing that the cells of virus-induced tumors could be superinfected with other non-neoplastic viruses. From time to time throughout his career, Dr. Syverton contributed significantly to our understanding of the possible mechanisms by which viruses prevail and are perpetuated in nature. In this connection, he studied the host range of Western equine encephalomyelitis virus in various wild animal species and showed the hereditary transmission of this virus in the wood tick. In a similar vein, he demonstrated the potentiality of the trichina worm to serve as a transmitting agent for the virus of lymphocytic choriomeningitis. Later he extensively exploited the use of stable strains of mammalian cells, in the cultivation and study of viruses. This was a pioneering effort of great importance to virology. Lately, with Brand, he developed a hemagglutination test for the species determination of cultivated mammalian cells. What was probably Dr. Syverton's most significant contribution was made very recently when he discovered with McLaren and Holland that the ribonucleic acid of poliovirus could infect nonprimate cells that were ordinarily refractory to infection with complete poliovirus. The importance of this discovery is very great and its significance to virus work in general and tumor virus work in particular will undoubtedly be far-reaching."

Syverton's stature in science and academic medicine was evidenced by his membership in 22 professional societies and on 11 scientific advisory committees, and his enthusiastic support of science at an international and national level was widely recognized and appreciated. The world's scientific community has lost a creative and productive investigator; the educational community, an enthusiastic teacher; the community of his colleagues and associates, a true friend; and his family, an affectionate and lovable father. As Shope expressed it in speaking of him to Minnesota medical students, "Dr. Syverton was a fine scientist, a gentleman, and a grand person to have as a personal friend. I think that you were fortunate indeed to have had him as one of your professors for as long as you did."

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Note

1. R. E. Shope, in "The case of a lurking virus and its exposé," a lecture presented to medical students at the University of Minnesota on 14 Feb. 1961.