Table 1. Calcium and strontium concentrations in bovine bone ash. Figures in the same column with different superscripts (a, b, c) differ significantly at $p < .05$.

Bone	Ca (%)	Sr (μg/g)	Sr^{90} (pc/g)	Sr^{90} (pc per gram of Ca)
Rib	34.8[a]	238[a]	23.1	66.3[ab]
Femur	35.1[a]	287[c]	24.4	69.5[b]
Humerus	35.6[a]	265[ac]	22.9	64.2[ab]
Frontal	35.4[a]	305[c]	25.7	72.7[b]
Incisors	40.1[b]	255[a]	20.2	50.2[a]
Thoracic vertebra	34.9[a]	265[ac]	23.3	66.8[ab]
Caudal vertebra	34.5[a]	272[ac]	24.1	69.7[b]
Average	35.8	270	23.4	65.6

Table 2. Concentrations of calcium, strontium, and strontium-90 in bone ash of cattle of different ages. Figures in the same column with different superscripts (a, b, c, d) differ significantly at $p < .05$.

Animal	Ca (%)	Sr (μg/g)	Sr^{90} (pc/g)	Sr^{90} (pc per gram of Ca)
Calf	34.6[a]	214[a]	19.4[a]	55.9[a]
Yearling	36.0[b]	243[ab]	20.2[ab]	55.7[a]
2-yr-old	36.5[b]	266[bc]	25.9[bc]	72.5[ab]
3-yr-old	36.2[b]	300[cd]	26.9[c]	74.7[b]
Cow	35.5[b]	327[d]	24.6[abc]	69.4[ab]
Average	35.8	270	23.4	65.6

others (*4*) have reported no differences in total strontium content in different human bones. It appears either that there is a species difference or that uncontrolled environmental factors mask this effect in man.

The concentration of strontium-90 apparently reached a maximum in the 2-year-old animal and remained about the same thereafter, although it was somewhat lower in the older animals. The 2- and 3-year-old animals were born immediately before the initiation of the test ban in 1958. The maximum level of strontium-90 in their bones by birth date precedes by 1 year the maximum level found in U.S. milk and the maximum deposition rate (*5*).

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16 January 1962

Proposed Explanation of Luminous Particles Observed in Glenn Orbital Flight

Abstract. It is proposed that the luminous particles observed by John Glenn in his orbital flight are condensed nitrogen and possibly oxygen. Irradiation by the sun would produce excited trapped radicals, which would radiate in ways consistent with the observed behavior of the particles.

One of the most surprising new phenomena observed by Glenn in his orbital flight on 20 February 1962 was the swarm of luminous particles near the space capsule. These particles have been described by him recently (*1*). Several critical facts observed by him should be summarized here. (i) The particles were luminous after "sunrise"—that is, after they were exposed to radiation from the sun; (ii) they were light yellow-green in color; (iii) their luminosity was observable for approximately 4 minutes after sunrise.

Two questions are of main concern: What are these particles, and where do they come from? I propose that the particles are solid nitrogen, possibly with some oxygen admixed; that they become luminous when radiation from the sun produces free radicals in the particles; and that the luminosity ceases when the particles are warmed up sufficiently by the radiation.

Solid nitrogen which is bombarded by x-rays and ionizing particles becomes luminous (*2*). The luminosity is related to forbidden transitions of nitrogen atoms (^2D to ^4S), and of oxygen atoms (^1S to ^1D) if any are present (*3*). In addition, molecular transitions from nitrogen and oxygen molecules are observed. The luminosity is light yellow-green; the exact hue depends on the chemical composition of the solid, on its temperature, and so on. The luminosity continues as long as the radiation continues, because a steady state is quickly reached. If the temperature rises above approximately 35°K, the luminosity disappears. It should be noted that pure solid oxygen does not become luminous if it is bombarded, but that oxygen species radiate if they are trapped together with nitrogen.

It seems most likely that the luminous particles observed by Glenn are indeed systems containing trapped nitrogen (and possibly oxygen) atoms. No other systems seem to have all the requisite properties. The present hypothesis is easy to check. Small, pocket spectroscopes carried along on the flight would suffice to show whether the luminosity lies in the regions of the spectrum appropriate for trapped nitrogen and oxygen atoms.

The second major question—Where do the particles come from?—is much more difficult to answer. They may exist independently at the altitudes involved. Indeed, Vegard proposed many years ago that such was the case (*4*). Or they might be produced from leaks of gas from the capsule, from gas trapped in various portions of the vehicle, and so on. This question will, however, be much easier to answer once the proposal made here has been verified or proved false.

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References and Notes

1. *Aviation Week* **76**, 63 (23 Apr. 1962); *Science*, this issue, p. 1093.
2. This is a well-known fact. For details see *Formation and Trapping of Free Radicals*, A. M. Bass and H. P. Broida, Eds. (Academic Press, New York, 1960).
3. The details of the transition are far from clear, but there is little doubt that atoms in these states play a prominent role in the emissions. For a recent discussion see C. M. Herzfeld, "A survey of theoretical work on trapped radicals at the National Bureau of Standards," in "Stabilization of Free Radicals at Low Temperatures," *Natl. Bur. Std. (U.S.) Monograph No. 12* (1960).
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Aragonite in the Resilium of Oysters

Abstract. Aragonite (orthorhombic $CaCO_3$) composes some of the fibers of the resilium of *Crassostrea virginica* (Gmelin).

The ligament of oysters consists of two kinds of conchiolin, but is divided into three portions, adjoining lengthwise. The outer layer [outer layer of Trueman (*1*) = lamellar ligament of Newell (2)] is nonfibrous, more translucent than the other layer, and dark brown; it makes up the two flanking portions of the adult ligament, anterior and posterior to the resilium, and is strong under tension and bending stresses. The inner layer [inner layer of Trueman = fibrous ligament of Newell] is fibrous, semitranslucent, and whitish-gray, and has light brown growth layers; its very fine fibers are nearly normal to its ventral or growing border. It makes up the resilium, which is the median one of the three portions; it is strong under compression, but weak to tension. The resilium is calcified, as a simple test with hydrochloric acid will