

266 $m\mu$ and a smaller peak at about 310 $m\mu$. This spectral behavior can be accounted for if the formation of both the glycol and the 4-dihydro, 5-hydroxy compound (I) are assumed to occur in the ratio of about 1:3. The glycol gives, on acid treatment, dimethyl isobarbituric acid and the dihydro-hydroxy compound, after the acid-catalyzed dehydration, gives dimethyl uracil with an absorption maximum at 266 $m\mu$ in both acid and alkali solutions.

The dihydro-hydroxy product and the glycol have also been characterized in other ways.

1) Chromatography of the product treated with acid showed the presence of both dimethyl isobarbituric acid and dimethyl uracil.

2) The rate of formation of the ultraviolet-absorbing product on treatment with acid was compared with the rate of formation of the ultraviolet-absorbing product formed photochemically from dimethyl uracil.

The second order rate constant (at 25°C) of the acid-catalyzed restoration of the ultraviolet absorption at pH 1.30 was found to be 1.13×10^{-2} lit. mole⁻¹ sec⁻¹ for the photochemical product and 1.10×10^{-2} lit. mole⁻¹ sec⁻¹ for the product obtained on irradiation with x-rays; this latter value was confirmed by measurements of the rate of double-bond restoration from the uptake of molecular bromine, which gave a rate constant of 1.12×10^{-2} lit. mole⁻¹ sec⁻¹.

These figures support the conclusion that one of the products formed by x-irradiation of aqueous solution of dimethyl uracil, in the absence of oxygen, is the 4-dihydro, 5-hydroxy compound, identical with that produced photochemically (6).

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Five New Minerals from Moctezuma, Sonora, Mexico

Abstract. Five new minerals have been found in a tellurium deposit near the town of Moctezuma, Sonora, Mexico. Preliminary study shows that they are a lead-oxy-fluoride, a zinc tellurite or tellurate, a manganese-zinc tellurite or tellurate, a manganese tellurite or tellurate, and an iron tellurite or tellurate.

Mineralogical interest in the deposit at Moctezuma was first aroused by the identification of several rare minerals, including mackayite, emmonsite, tellurite, native tellurium, and paratellurite. Paratellurite was recently described by Switzer and Swanson (1). Moctezuma is the second occurrence of mackayite and paratellurite.

Five new species of minerals have been found in this deposit. Since complete chemical data are not available, the naming of these minerals is being delayed. Preliminary descriptions of the five minerals follow.

Lead-oxy-fluoride, which was found in extremely small amounts, occurs as minute, yellow plates with a high adamantine luster. The x-ray powder data agree with those for synthetic Pb₂OF₂ published by Byström (2). The x-ray data and appearance of material synthesized during the present study are the same as those of the natural mineral. At present, there is not enough of the mineral for a chemical analysis.

Zinc tellurite or tellurate occurs as small, brown, hexagonal prismatic crystals terminated by a bipyramid. It is optically uniaxial positive with $\omega = 1.85 \pm 0.01$ and $\epsilon = 1.93 \pm 0.01$. A spectrographic analysis gave only zinc and tellurium as major constituents. The x-ray powder data do not match those of any known tellurium minerals. The strongest spacings (in angstroms) are 8.1 (very strong), 4.04 (strong), and 2.75 (strong).

Manganese-zinc tellurite or tellurate is a red to purple mineral which occurs in platy masses. Partial optical data are: biaxial positive, $2V = 60^\circ$ (estimated), $\beta = 1.89$, and $\gamma > 2.10$. The specific gravity, determined with the Berman balance on 20 mg of material, is 5.01 ± 0.02 . Since only manganese, zinc, and tellurium were reported as major constituents by spectrographic analysis, the mineral is probably a manganese-zinc tellurite or tellurate. X-ray powder data are different from those of known tellurium minerals. The strongest spacings (in angstroms) are

2.98 (very strong), 3.30 (strong), 1.62 (strong), 4.00 (strong —), 4.93 (medium strong), and 2.21 (medium strong).

Manganese tellurite or tellurate occurs as pale green to colorless platy masses and occasionally as small euhedral crystals. The crystals are plates and have an octagonal shape. The material examined has variable physical properties, and an isomorphous series is indicated. The following data are averages of values obtained from several samples. The mineral is optically biaxial positive, $2V = 15^\circ$ (estimated), α and β are approximately 1.89, and γ is about 2.0. The specific gravity is 5.05. Spectrographic analysis yielded manganese and tellurium as major constituents and zinc in lesser amount. Strongest spacings (in angstroms) are 2.03 (strong), 3.36 (strong —), and 2.61 (strong —).

Iron tellurite or tellurate (a mineral or mineraloid) is amorphous to x-rays and occurs as red-brown botryoidal coatings. Optically the material is very weakly anisotropic and has a mean index of 1.885 ± 0.005 . The specific gravity is about 3.7. Only iron and tellurium were detected as major constituents by spectrographic analysis.

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Evaluation of the Origins of Strontium-90 Contained in Wheat Plant

Abstract. Twenty percent of the strontium-90 in wheat flour in 1959 was due to root absorption, 30 percent was due to floral absorption from soil particles attached to the ear, and 50 percent was due to current fallout. In 1960, 35 percent was due to root absorption, 50 percent to floral absorption from soil, and 15 percent to current fallout.

For evaluation of the Sr⁹⁰ hazard level in the future, the argument concerning radioactive contamination of wheat and other cereals by fallout has been narrowed down to the problem of how much Sr⁹⁰ in grain depends on the

Table 1. Strontium-90 concentration (strontium unit, micromicrocurie of Sr^{90} per gram of Ca) in various parts of wheat plants harvested in 1959 and 1960. Treatment I is the sample with the ear covered with a paraffin-paper envelope during the period from ear-shooting to harvest. Treatment II is the sample with the whole plant covered with a polyethylene sheet during the same period.

1959	1960	1960	
		Treat- ment I	Treat- ment II
		<i>Leaf</i>	
650	180	180	92
		<i>Husk</i>	
1800	690	190	82
		<i>Bran</i>	
340	80	30	37
		<i>Flour</i>	
160	95	38	25

cumulative Sr^{90} deposition in soil and how much depends on the current Sr^{90} fallout rate (1).

The wheat plants harvested in 1959 and 1960 at Chiba City were analyzed for Sr^{90} content. In addition, special treatments were applied to the 1960 samples. One group from this year was covered with a polyethylene sheet on the whole body from the shooting stage until harvest; another group was covered, during the same period, with a paraffin paper envelope on the ear only to eliminate the floral absorption of Sr^{90} .

The concentrations of Sr^{90} in various parts of wheat were found to be much lower in 1960 than in 1959. This should be caused by the marked decrease of the Sr^{90} fallout rate in the spring of 1960 compared with that during the corresponding period in 1959. But the difference in the Sr^{90} content in wheat during these years is so small compared with the remarkable difference in the Sr^{90} fallout rate in the spring of these two years. The monthly fallout rate of Sr^{90} from April to June in 1959 was approximately 1 to 2 mc/km^2 ; for the same period in 1960 it was 0.2 to 0.3 mc/km^2 (2). This period is from ear-shooting to harvest of the wheat plant. Direct Sr^{90} contamination of grain by current fallout would be mostly from fallout during this period, because not much radioactive strontium, which has

accumulated in the foliage, can be transmitted to the ear of the cereal plant (3).

From the above considerations, if the current fallout of Sr^{90} were the main contributor to the content of Sr^{90} in the grain, the content should be five times lower in 1960 than in 1959. But wheat flour showed a decrease of only one-half, or less, of the Sr^{90} content in 1960. These phenomena suggest that the cumulative deposit of Sr^{90} on land might have an important role in the amount in cereals. As for root absorption, the wheat-flour sample treated with the covering as stated already, which eliminated the floral absorption of Sr^{90} , showed about one-third of the amount in the untreated sample, as shown in Table 1. This value indicates the amount of Sr^{90} due only to root absorption from soil. Therefore, another fraction of Sr^{90} , namely two-thirds of the amount in flour in 1960, is due to floral absorption. But this is too large to be assumed to be due to current fallout of Sr^{90} , because the fallout rate of Sr^{90} in this period was only one-fifth of that in the corresponding period in 1959. Therefore, a pretty large fraction of this floral absorption might be due to the fine particles of surface soil raised up by the wind and adhering to the ear of the plants. The Sr^{90} in these particles might be absorbed directly into the grain. Thus Sr^{90} found in wheat flour could be separated into the following three categories, according to their absorptive routes: (i) floral absorption from current Sr^{90} fallout (x , 1960; $5x$, 1959); (ii) floral absorption from Sr^{90} in soil particles (y , 1959 and 1960); (iii) root absorption from cumulative Sr^{90} in soil (z , 1959 and 1960).

If the variables x , y , and z can represent the three fractions shown above, the following formulas can be obtained by using the values from Table 1.

$$5x + y + z = 160$$

$$x + y + z = 95$$

$$z = 30$$

On solving these formulas, the values of $x = 16$, $y = 55$, and $z = 30$ were obtained. With these values, obtained

Table 2. Evaluation of each fraction of Sr^{90} in wheat flour due to various origins of contamination. Amounts are in strontium units. Numbers in parentheses indicate percentages.

Origin	1959	1960
<i>From soil</i>		
Root absorption	30 (20)	30 (35)
Floral absorption	50 (30)	50 (50)
<i>From current fallout</i>		
Floral absorption	80 (50)	15 (15)

as above, the amount of Sr^{90} in wheat flour in 1959 and 1960 can be interpreted as shown in Table 2. As shown in the table, for the Sr^{90} content in wheat flour in 1959, when fallout of Sr^{90} was quite high in the spring, the current fallout rate contributed to one-half of the amount of Sr^{90} . On the contrary, in 1960, when the fallout rate was much lower, the current fallout rate contributed to only one-sixth or one-seventh of the amount. The floral absorption from the soil particles raised up by the wind was the largest contributor.

For bran, husk, and leaf, the contribution of the current fallout rate is assumed to be larger than for wheat flour, as seen in Table 1.

From these considerations, the Sr^{90} content of wheat flour is assumed to maintain the level of the 1960 sample, unless the Sr^{90} content in soil should change for any reasons, such as leaching out, decrease of availability for plant, and so forth, because the present level of Sr^{90} in wheat flour is mostly (approximately 80 to 90 percent) originating from soil contamination (4).

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