studied; and oocytes in the ovaries of the three animals exhibiting a relatively lower activity (for example, animal 3, Table 1) were either in preyolk stages or in early stages of the deposition of yolk. Further experiments with animals at graded stages of vitellogenesis are in progress to furnish more precise information on the correlation between the uptake of glycine and the synthesis of yolk.

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17 December 1954.

Crystal Structure of Rutherfordine, UO_2CO_3

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Crystals of the mineral rutherfordine, UO_2CO_3, used in this study (*1*) are pale yellow to brown and are lathlike elongated along [001], with large (100) and somewhat less dominant (010). Cleavage parallel to (010) is perfect. Precession and Weissenberg patterns yield the following data: orthorhombic, space group—$Pm2_1n$ (C_{2v}^7) or Pmmn (D_{2h}^{13}); cell contents, $2UO_2CO_3$; $a = 4.84_5 \pm 0.010$ A; $b = 9.20_5 \pm 0.008$; $c = 4.29_6 \pm 0.006$; density (calc.) $= 5.72_4$ g cm^{-3}. (Moλ: $K_\alpha = 0.71069$ A, $K_{\alpha_1} = 0.70926$ A). Miller *et al.* (*2*) found the density of synthetic UO_2CO_3 to be 5.7 g cm.$^{-3}$

All of the observed reflections obey the criterion $h + k + l = 2n$, except a very weak set that appears only on strongly exposed photographs; for this set when $h + k = 2n$, $l = 2n + 1$, and when $h + k = 2n + 1$, $l = 2n$. The intensities of the strong reflections follow an essentially normal atomic form-factor decline with increasing sin θ/λ.

Through consideration of these experimental results and a knowledge of the nature of the uranyl ion, $(O\text{-}U\text{-}O)^{++}$—namely, that it is collinear (*3*) and has U-O distances of 1.93 A (*4*)—it was possible to derive the structure of UO_2CO_3 without recourse to quantitative intensity measurements. This structure is illustrated in Figs. 1 and 2 (top). It is isomorphic with the space group Pmmn and has the following atomic parameters (assuming C-O distances of 1.28 A).

2 U at (b): $\pm(\frac{1}{4}, \frac{3}{4}, z)$; $z = 0.750$
2 C at (a): $\pm(\frac{1}{4}, \frac{1}{4}, z)$; $z = 0.601$
2 O_I at (a): $\pm(\frac{1}{4}, \frac{1}{4}, z)$; $z = 0.303$
4 O_{II} at (e): $\pm(\frac{1}{4}, y, z; \frac{1}{4}, \frac{1}{2} - y, z)$; $y = 0.960, z = 0.750$
4 O_{III} at (f): $\pm(x, \frac{1}{4}, z; \frac{1}{2} - x, \frac{1}{4}, z)$; $x = 0.021, z = 0.750$
(origin at $\bar{1}$)

The structure described is the ideal one for rutherfordine. Actually, the x-ray patterns of the crystals examined exhibit diffuse streaking, in the direction of the b^*-axis, of the weak reflections. This observation is explained in the following way. The carbonate groups may in alternate layers point in opposite di-

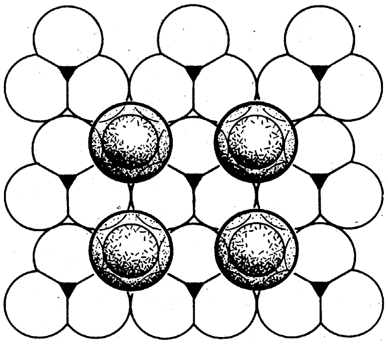

Fig. 1. Structure of a layer in UO_2CO_3, parallel to (010). The UO_2^{++} groups lie normal to the plane with the uranium atoms lying in the hexagonal holes formed by the carbonate groups. Each uranium atom has six bonds lying in the plane, with distances U-O_{III} (4) = 2.52A, U-O_I (2) = 2.43 A, and two bonds normal to the plane with U-O_{II} = 1.93 A (assumed).

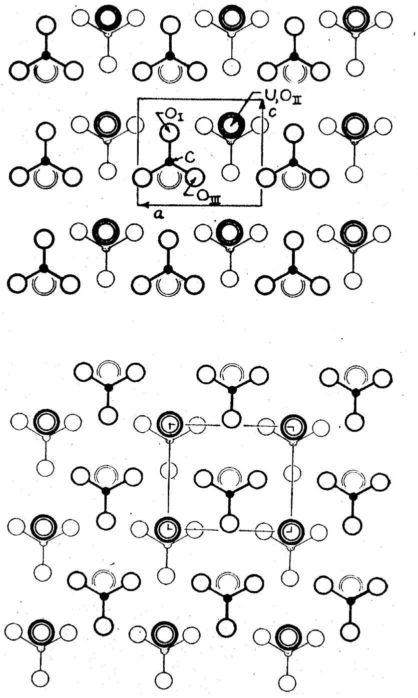

Fig. 2. Structure of UO_2CO_3 projected on (010). The atoms drawn in heavy lines all lie in one plane, those drawn in light lines in another plane, with the two planes separated by $b/2 = 4.60$ A. Structure A (ideal) (top) and structure B (bottom) differ in the way that the CO_3^{--} groups point in successive layers.

rections along the c-axis, as in the ideal structure (structure A, Fig. 2), or in the same direction (structure B, Fig. 2), without appreciably changing the environment of any atom. Hence, the two structures must be energetically nearly equivalent. As a result, in actual crystals of rutherfordine, faults occur in the stacking of the layers; regions in which the sequence of layers corresponds to structure A are occasionally terminated by regions in which the layers follow the sequence of structure B. There is evidence that the degree of disorder may differ significantly from crystal to crystal, perhaps as a function of the age of the crystals. This situation has not yet been completely analyzed.

References and Notes

1. Publication of this paper was authorized by the director of the U.S. Geological Survey. This work was completed as part of a program undertaken by the U.S. Geological Survey on behalf of the Division of Raw Materials of the U.S. Atomic Energy Commission. We are indebted to Clifford Frondel of Harvard University for the mineral specimen from which the crystals of rutherfordine were obtained. A detailed discussion of the structure of rutherfordine, particularly of the nature of the disorder and its mineralogical implications is in preparation.

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Communications

Big Business and Research

R. W. Lippman has made a comment [*Science* **120**, 1036 (1954)] about big business and scientific research that runs counter to my own experience. I think it creates, moreover, a rather false notion of the way many business corporations look on the role of basic science in today's world. Lippman states that anyone who has tried to find money for basic research from business organizations knows the difficulties. He states that even what business calls basic research is not that but, rather, something of limited scope and usually directed toward the solution of a specific project in which the company has a direct business interest.

It is true that responsible officers of large corporations often feel that their support of basic scientific research must be directed toward something with relevance to the operations of the company. But this does not mean that such officers seek to impose limitations on the nature of the research, its directions, or its outcome. Moreover, there is a fast-growing tendency for the managements of many large corporations to make very liberal interpretations of the interests of the companies in judging what is proper for them to support.

Our observatory has just completed the construction of a new solar laboratory made possible by some 37 nongovernment donors. The building will be used for fundamental research in solar astronomy. No specific company will gain direct benefit from our research, although the welfare of the nation as a whole will be advanced. No "practical" goals have been set for our study, and no conditions of any sort have been imposed by any donor. I have just made a quick count, and, of the 37 contributors, 11 were corporations, six of which are definitely in the category of "big business." In addition, at least nine contributions were made by individuals who were primarily businessmen. Moreover, seven additional contributions were given by foundations established by men who had made their fortunes in business.

Naturally we expect that our basic research will have widespread practical application and, thus, will materially benefit a wide variety of interests. But no individual company can expect to be preferentially aided. The support so generously given is for basic research—and the fact that such support is available is an evidence, to my mind, of the sound insight of these business executives into the role of fundamental science in modern life.

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Influence of Humic Acids on Plant Growth

Recently attention has been paid to the ferric chelate of ethylenediamine tetraacetic acid (EDTA) as a source of iron for plants in nutrient culture (*1*) and for chlorotic fruit trees (*2*). Evidence that the FeEDTA molecule was absorbed and translocated as a whole was provided by supplying FeEDTA containing isotopically labeled nitrogen, whereupon it was found that the amounts of iron and isotopic nitrogen reaching the leaves were in stoichiometric agreement (*3*).

In recently described experimental work (*4*) in which the roots of a sunflower plant were divided so as to absorb nutrients from two containers, it was demonstrated that the plant grew healthily if EDTA was supplied to one compartment and iron and phosphate to the other, whereas the plants became chlorotic if EDTA was omitted.

In our earlier work (*5*) we showed that the growth-promoting effect of a lignite was the result not of its trace-element content but of humic substances that made iron in the nutrient solution readily available (*6*), even in the presence of high phosphate. Iron chlorotic plants were found to have high concentrations of iron in the roots, probably immobilized as