ROENTGENITE, $3CeFCO_3 \cdot 2CaCO_3$, A NEW MINERAL FROM GREENLAND*

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In the course of an *x*-ray study of bastnaesite ($CeFCO_3$), parisite ($2CeFCO_3 \cdot CaCO_3$), and synchisite ($CeFCO_3 \cdot CaCO_3$), a new species, $3CeFCO_3 \cdot 2CaCO_3$, was found and named *roentgenite*. A description of the relations of this mineral to the others will appear in this journal in the near future. The purpose of this note[1] is to put on record the properties of roentgenite itself.

CRYSTALLOGRAPHY: Hexagonal—*R*. Trigonal pyramidal, 3.
Axial ratio: $c/a = 9.74 \pm 0.03$.

FORMS:

		ϕ	ρ
c	0001	—	0°00′
q	$10\bar{1}1$	30°00′	84°55′ (calc., poor reflection)
p	$01\bar{1}2$	−30°00′	79°55 ±2′ (meas.: 79°54′, 54′, 56′, 57′)

{0001} is always small so that it may be written {0003}. All observed forms then obey the rhombohedral criterion: $-h+k+l=3n$.

CLEAVAGE: No cleavage is observed.

STRUCTURE: Laue class $\bar{3}$; diffraction aspect R**. The center of symmetry is ruled out by twinning (see below) and because the structure is closely related to that of bastnaesite, which is strongly piezoelelectric (Oftedal, 1931, p. 465). The space group is therefore $R3$ (C_3^4). Cell dimensions: $a_0 = 7.13_1 \pm 0.02$ Å, $c_0 = 69.4_1 \pm 0.2$ Å, $c_0/a_0 = 9.73_3$. Cell contents: 9 ($3CeFCO_3 \cdot 2CaCO_3$). A pronounced pseudo-cell has pseudo-space group $C\bar{6}m2$; $a' = a_0/\sqrt{3} = 4.11_7$ Å, $c' = c_0/3 = 23.1_{35}$ Å, $Z=1$. Another, smaller, pseudo-cell has diffraction aspect C***; $a' = 4.11_7$ Å, $c'' = c'/5 = 4.62_7$ Å. The structure consists of horizontal layers, in which cerium and fluorine ions alternate at the corners of hexagons. Vertical and nearly vertical carbonate groups separate these layers from each other and from calcium layers. Calcium ions lie above cerium ions (Fig 1).

HABIT: Similar to that of parisite and synchisite. Most crystals are singly terminated, with *q* and *p* dominant, truncated by a small monohedron *c*. The two pyramids are striated horizontally (Fig. 2).

TWINNING: Twinning by reticular merohedry, uncommon, defined by reflection in twin plane and composition plane (0001). Twins are doubly terminated, showing twin symmetry $\bar{6}$ or $\bar{6}m2$, which rules out $\bar{3}$ as a possible point group.

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[1] This work was done on behalf of the Division of Research of the U. S. Atomic Energy Commission.

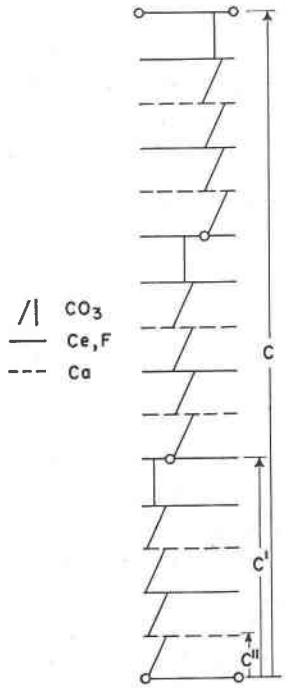

FIG. 1. Schematic presentation of the crystal structure of roentgenite. Rhombohedral lattice points shown along diagonal of rectangle.

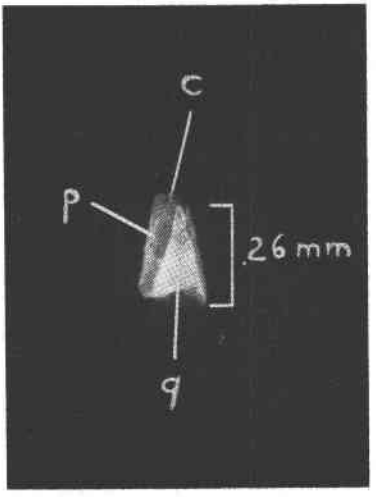

FIG. 2. Roentgenite crystal showing forms $q\{10\bar{1}1\}$, $p\{01\bar{1}2\}$, and $c\{0003\}$.

PHYSICAL PROPERTIES: The fracture is subconchoidal. Crystals are transparent to translucent and wax-yellow to brown. The crystals were too small for the specific gravity to be determined experimentally; the calculated value is 4.19.

OPTICAL PROPERTIES: Colorless to light yellow in transmitted light. Uniaxial positive; $\omega = 1.662 \pm 0.002$, $\epsilon = 1.756 \pm 0.005$ (in sodium light). The indices were measured by H. W. Jaffe of the U. S. Geological Survey.

CHEMICAL COMPOSITION: Because of the almost universal intergrowth of this mineral with bastnaesite, parisite, or synchisite, not enough pure material was available for a chemical or even a spectrographic analysis. The composition was obtained as follows, from a plot of cell dimension c'' (in Å) vs. composition ($CaCO_3$ in mol %). The c'' values for bastnaesite (4.89_4) and parisite (4.67_3) are plotted, and a straight line is drawn through them. The observed c'' of roentgenite corresponds exactly to 40.0 mol % $CaCO_3$ so that the formula is $3CeFCO_3 \cdot 2CaCO_3$. The fact that the observed c'' of synchisite (4.56_0) corresponds exactly to 50.0 mol % $CaCO_3$ indicates that the linear relationship is indeed obeyed. The composition is further confirmed by the crystal structure and the refractive indices, $\omega = 1.654$, $\epsilon = 1.755$, calculated from it. These indices are obtained from the relations.

$$\frac{\epsilon^2 - 1}{\epsilon^2 + 2} \cdot \frac{MW}{G} = \sum_i (R_\epsilon)_i N_i; \qquad \frac{\omega^2 - 1}{\omega^2 + 2} \cdot \frac{MW}{G} = \sum_i (R_\omega)_i N_i$$

where MW is the molecular weight, G the specific gravity, R_ϵ (or R_ω) the ionic refractivity, and N_i the number of atoms of the i^{th} element in the molecule.

Cerium is presumably replaced by other rare earths, as this is known to be the case in the associated minerals.

TESTS: Crystals dissolve in strong acids, for instance 6N HNO_3. In solubility roentgenite is intermediate between synchisite and parisite.

OCCURRENCE: Roentgenite occurs intimately associated with synchisite, parisite, and bastnaesite at Narsarsuk, Greenland. Syntaxic intergrowths with each of the other species are common; they simulate single crystals. The boundary surface between the two species is planar, or irregular, or both.

The work reported was done on material kindly supplied by the U. S. National Museum (Specimen Nos.: R2609, R2613, and R2615) and the Harvard University Museum (No. 84233).

NAME: The mineral is named after Wilhelm Konrad Roentgen (1845–1923), discoverer of x-rays, because x-ray methods alone proved its existence and established its formula.

REFERENCE

OFTEDAL, I. (1931), Zur Kristallstruktur von Bastnäsit: *Zeits. Krist.*, **78**, 462–469.

It has been announced by Paul T. Allsman, Regional Director Region V, that a new laboratory pilot plant for the recovery of beryl, a rare and critical mineral with many military and industrial uses, found in South Dakota's rich Black Hills, will begin its first test run in the Pegmatite Research Laboratory of the U. S. Bureau of Mines, Department of the Interior, in Rapid City. Laboratory tests at Rapid City have indicated that ore as low as 0.1 per cent beryl can be successfully concentrated with a recovery of 85 per cent. In recent years, South Dakota has produced about 100 tons of beryl annually—approximately 50 per cent of domestic production.

The Ohio State University conferred the degree of Doctor of Science on William J. McCaughey, Professor Emeritus of Mineralogy, in recognition of his contributions through the teaching of applied mineralogy. The degree was conferred at Columbus on June 12, 1953.

The Eleventh Annual Pittsburgh Diffraction Conference will be held at Mellon Institute, Pittsburgh, Pa., on November 5 and 6, 1953. Technical sessions are being arranged on *Instrumentation and Methods, Metals, Recrystallization and Preferred Orientation,* and *Structure of Polymers*. Papers on general diffraction subjects will also be accepted.

Contributed papers will be considered in the order in which they are received. Titles should be submitted to the Program Chairman, Mr. E. E. Wicker, United States Steel Corporation, Research and Development Laboratory, 234 Atwood Street, Pittsburgh 13, Pa., before September 1, 1953. Abstracts should be submitted by September 21. For further information, and for a copy of the preliminary program when available, write to Dr. H. R. Letner, Mellon Institute, Pittsburgh 13, Pa.

The American Geological Institute has announced the appointment as its Executive Director Mr. C. B. Hunt, currently Chief of the General Geology Section of the U. S. Geological Survey with headquarters in Denver, Colorado. He assumed his new duties on Sept. 1, 1953. Also the appointment of Dr. H. Richard Gault to serve as Executive Secretary of the Division of Earth Sciences has been announced by the Academy Council. His appointment became effective July 1.

On October 1, 1953, the Mineralogical Society of Philadelphia is devoting a meeting to the memory of Samuel G. Gordon. Dr. W. Parrish will be the scheduled speaker; he will talk on "Gordon's contribution to mineralogy."

Dr. Fred. E. Wright, petrologist of the Geophysical Laboratory from 1906 to his retirement in 1944, president of the Mineralogical Society of America in 1941 and recipient of the Roebling Medal in 1952, died at his summer home in Gananoque, Ontario, on Aug. 25, 1953, at the age of 75 years.

Albert A. Klein, assistant director of research at the Norton Company, suffered a heart attack and died Aug. 25, at the age of 64. Mr. Klein's special interests included microscopic and x-ray techniques as applied to bonded abrasives and refractories.