THE DETERMINATION OF THE HELIUM CONTENT OF SOME JAPANESE MINERALS.

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F. Bordas[1] has already noted the presence of helium in naegite, a radioactive mineral occurring in the Naegi district, Japan. No quantitative study on this line, however, having been made on the Japanese specimens of other minerals, so the author has undertaken the present investigation. That most minerals when simply heated evolve nearly half the amount of total helium contained, has been described by M. W. Travers,[2] and this method of extraction was adopted for the following helium determination.

The apparatus used was constructed according to the description of R. J. Strutt,[3] some parts of which were conveniently modified. A quantity of the powdered mineral was introduced in a quartzglass tube placed in an electric furnace, and heated in the exhausted state after having been washed with pure oxygen to remove all the air in the tube. The gas evolved was passed over solid potassium hydroxide, copper oxide heated to redness, and lastly over soda-lime, so as to remove most of hydrogen and carbon dioxide. The remaining gases were collected by a Toepler pump in an explosion eudiometer with platinum wires sealed in the top, and mixed with an excess of oxygen, the brush arc was then allowed to produce in the mixture by means of an induction coil to convert nitrogen into nitric oxide. The nitric acid thus formed was removed by the moistened fragments of solid potassium hydroxide floating on the surface of mercury in the eudiometer. After this operation was over, the excess of oxygen was absorbed by melted phosphorus. The gas, which was left unabsorbed and dried by phosphorus pentoxide, was introduced into a modified Geissler tube provided with electrodes of liquid alloy of potassium and sodium. Having been discharged between these electrodes, all traces of nitrogen, hydrogen, and carbon compounds were removed, and the remaining gas was finally subjected to the action of cocoanut charcoal chilled by liquid air. The gas thus having remained in apparatus was invariably pure helium which were always confirmed spectroscopically, and transferred into a narrow graduated burette where its volume was measured. The results are given in the following table.

(1) *Compt. rend.*, **146** (1908), 628.
(2) *Proc. Roy. Soc.* (*London*), A, **64** (1898), 141.
(3) *Proc. Roy. Soc.* (*London*), A, **80** (1908), 572.

Mineral	Locality	Sample taken, gr.	Helium yielded, c.c. at N.T.P.	Helium c.c. per gr. of mineral	Helium %
Fergusonite	Naegi	10.03	1.16	0.12	0.0021
Monazite	Ishikawa	17.76	2.71	0.15	0.0027
Monazite sand	Sekigammen	60.95	9.53	0.16	0.0028
Monazite sand	Shokuzan	20.21	1.91	0.095	0.0017
Beryl	Ishikawa	40.93	0.10	0.0025	0.000044
Beryl	Tanokami	20.47	No He. was detected	—	—
Beryl	Naegi	20.82	No gas was evolved	—	—

According to Prof. Y. Shibata and K. Kimura,[1] monazite of Ishikawa contains 2.91 percent of ThO_2 and 0.85 percent of UO_3, while fergusonite of Naegi 11.08 percent of ThO_2 and 0.42 percent of UO_3. Using these data, the geological ages of both minerals were calculated after the method of E. Rutherford.[2] The volumes of helium, which are to be produced per year from each gram of these two minerals are 3.4×10^{-6} c.mm. and 1.57×10^{-6} c.mm. respectively. At these rates, the time required to produce twice the quantity of helium given in the above table is 90 million years for monazite and 150 million years for fergusonite. The comparatively lower values of helium content of those minerals may thus be ascribed to their younger geological ages.

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(1) *J. Chem. Soc. Japan*, (in Japanese), 42 (1921), 1 & 957.
(2) "Radioactive Substances and Their Radiations," (1913) p. 562.