On the Equilibrium of the Radioactive Elements in the Hydrosphere. V.[1] A Simple Method for Distinguishing Uranium and Thorium in Radioactive Minerals.

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(Received November 16, 1948.)

It was found that the uranium and thorium in radioactive minerals are easily distinguished by measuring the radioactivity of radium emanation and thorium emanation in the minerals. Though this method is a qualitative one, it may be improved in future and it will be used as a quantitative method for determining the ratio of uranium to thorium in radioactive minerals.

Method of Experiment. Several grams of powdered minerals are taken in a vessel, and 50 to 100 c.c. of water are added. The radioactivity of the water is measured on the next day. The water is taken with an injector (about 50 c.c.), as quickly as possible, and the radioactivity is measured at once. In the case of thorium minerals, a rapid decay curve of thorium emanation will be obtained and in th ecase of uranium minerals, on the other hand, the radioactivity will increase gradually as the result of the formation of the decay products of the radium emanation. In the case of radioactive minerals containing both series of radioactive elements, the radioactivity of radium emanation and thorium emanation will be simultaneously observed.

Results of Experiment. (a) Pitchblende. The powdered sample of pitchblende (about 3 grams) was immersed in distilled water (about 50 c.c.) overnight. A 20 c.c. portion of the water was taken with an injector, as quickly as possible, and it was ejected in the ionization chamber of I.M. fontactoscope. The radioactivity measurement was commenced at once. An example of the experiments is shown in Table 1.

Table 1. Pitchblende.

Time (min.)	Radioactivity (div./min.)
1	7.7
2	7.3
3	9.0
4	9.5
5	10.5
6	13.5
7	13.0
16	16.7
17	17.0

The concentration of radium emanation in the water was calculated to be about 300 Mache. The radioactivity of thorium emanation

(1) Previous Paper. IV. K. Kuroda and Y. Yokoyama, this Bulletin, **22** (1949), 43.

was not observed, as the thorium content of pitchblende was low usually.

(b) Monazite. The powdered sample of monazite (10 grams) was immersed in the distilled water overnight. A 45 c.c. portion of the water was taken with an injector, as quickly as possible, and it was ejected in the ionization chamber of I.M. fontactoscope. The radioactivity measurement was commenced at once, and the following result was obtained (Table 2).

Table 2. Monazite.

Time (min.)	Radioactivity (div./min.)
1	2.4
2	1.2
3	0.8
4	0.8
5	0.5
6	0.7
7	0.4
8	0.6
9	0.7
10	0.4

Table 2 shows that the thorium emanation dissolves out from the mineral, but the radium emanation does not.*) The concentration of thorium emanation in the water is calculated to be about 30 Tn-Mache.

(c) Enalite. The thorium content of this mineral is about 55 per cent and the uranium content is about 25 per cent. Therefore, it may be expected that both thorium emanation and radium emanation will dissolve out from this mineral, when it is treated as described above.

The powdered sample of enalite (about 40 grams) was immersed in the distilled water (100 c.c.) overnight. A 70 c.c. portion of the water was taken with an injector, and it was ejected in the ionization chamber of I.M. fontactoscope. The result of the experiment is shown in Table 3.

Table 3. Enalite.

Time (min.)	Radioactivity (div./min.)
1	3.6
2	2.0
3	1.4
4	1.7
5	1.7
10	1.6
11	1.6
12	1.9
13	1.7
34	2.0
35	2.1
36	2.1
37	2.4

The concentration of thorium emanation in the water is about 40 Tn-Mache and that of radium emanation is about 10 Mache.

Summary.

It was found that the uranium and thorium in radioactive mineral are easily distinguished by measuring the radioactivity of radium emanation and thorium emanation in the minerals with I.M. fontactoscope.

The author expresses his hearty thanks to Professor Kenjiro Kimura for his kind guidance. The cost of this research was defrayed from the Scientific Research Encouragement Grant from the Department of Education, to which the author's thanks are due.

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*) Natural leak is about 0.5 div./min.