ON THE RADIUM CONTENT OF A NEW MINERAL FROM RAJPUTANA

By B. D. NAG CHAUDHURI*

ABSTRACT. The quantity of uranium and thorium present in the mineral has been determined by estimating the β-activity and the absorption in aluminium. The percentage of uranium by weight is 60% and that of thorium is 0.7%. The radium content of the mineral has been estimated and compared to the various radium ores from which radium is at present extracted. The feasibility of the present ore as a source of radium is discussed.

The quantitative estimation of uranium and thorium in a mineral can be made very conveniently from the radioactivity of the samples. For samples containing a very small amount of uranium and thorium, that is, less than a tenth of one per cent of the radioactive elements a method of estimating the radioactive content has been developed by Finney and Evans (1935), by counting the number of α-particles emitted by the sample and measuring their ranges. The method, however, ceases to be useful when the samples are very much stronger. The β-activity of the samples can then provide a quick and useful method of estimating uranium and thorium. The method developed in this laboratory, yields quick and accurate results as has been confirmed in three ways. The method consists mainly of an analysis of the absorption curve of the β-rays in aluminium and will be discussed in another paper. The results have been confirmed by (1) a chemical analysis of the sample, (2) the verification of the analysis by the method of Finney and Evans and (3) taking a known mixture of uranium and thorium and analysing by the β-absorption methods and the method of Finney and Evans. The results are summarised below. The β-ray ionisation chamber used for these measurements is filled with dry air at room temperature with a thin air-tight aluminium window.

Mineral	Method Used	Uranium	Thorium
Thorianite	Finney and Evans	20.0 ± 1.3%	61 9% ± 2%
	Nag and others (1924)		
Same	β-absorption	21.1 ± 1.1%	60.5 ± 1.8%
Same	Chemical analysis	21 ± 1 %	61.0 ± 1.1%
Mixture of 80%-uranium and 10%-thorium	Finney and Evans β-absorption	78.5 ± 2 %	10.2 ± 0.4%
		79.8 ± 1.3%	9.9 ± 0 3%

The present sample was an orange yellow mineral of altered appearance from Rajputana with a very high specific activity. Most of the activity was due to uranium which was present in the form of oxides and the sample may be described as an uranium ochre. One hundred milligrams of the mineral was taken from the sample which was first crushed to an uniformly fine powder to ensure an average sampling. The hundred milligrams were spread out in an aluminium disc to a uniform circle of five cms. diameter and used for the β-ray absorption measurements. The amounts of uranium and thorium contained in the mineral are given in percentages of the total weight of the mineral.

* Fellow of the Indian Physical Society.

Uranium	...	60.1 ± 1.2%
Thorium	...	0.7 ± 0.05%

This is a very high value of uranium content for any mineral and the high specific activity of the mineral compares favourably with the present uranium minerals usedi n the extraction of radium. The uranium content of the minerals most commonly in use for the extraction of radium are tabulated below :

Mineral	Locality	Uranium Max	Uranium Min.	Thorium	Remarks
Pitchblende (Report, 1905-38)	Colorado	68%	38%	Negligible	In use
Pitchblende (Keevil, 1938; Nier, 1941)	Joachimstal	60%	—	Negligible	Earliest source of radium
Pitchblende	Katanga (Congo)	73%	23%	Negligible	Largest source
Uraninite	Huron Claim	52%		10%	Canadian
Uraninite	Parry Sound	69%	51%	3%	,, richest ore
Uraninite	Wilberforce	54%	—	12%	Canadian

All these uranium minerals are mined or have been mined for radium and it may be noted that the uranium ochre under discussion compares favourably with the minerals listed, provided, of course, that the mineral occurs in large enough deposits to be mined economically. The actual amounts of radium available from these minerals may also be compared. The uranium ochre will yield 234 milligrams of radium per ton of the ore, whereas the Canadian ore from Parry Sound yields about 266 milligrams per ton of the ore. The highest yield possible is 285 milligrams per ton of ore, a figure that has not been reached by any available ore. The radium ores of Belgian Congo have been mined profitably even when the yield was as low as 130 mgms. per ton. The present ore thus stands comparison favourably when one remembers that the Canadian ore is flown from inaccessible regions and the Belgian ore has to be carried from inaccessible regions to the coast and thence to Belgium for extraction.

It is a pleasure to thank Prof. Saha and Dr. P. B. Sarkar for interesting discussions about the mineral. Thanks are also due to Mr. A. K. Mousuf for insetting the apparatus and taking readings.

Cyclotron Laboratory,
University College of Science,
Calcutta.

REFERENCES

Evans, 1941, *Jour. App. Phys.*, **12**, 297.
Finney and Evans, 1935, *Phys. Rev.*, **48**, 563.
Keevil, 1938, *Economic Geology*, **33**, 685.
Nag, Das & Das Gupta, 1944, *Proc. Nat. Inst.*, **10**, 167.
Nier, 1941, *Phys. Rev.*, **60**, 112.
Report, 1935-38, Committee on Determination of Geological Time of the National Research Council, U.S.A.