SAMARSKITE FROM NELLORE DISTRICT

Part I. Uranium and Earth Acid Contents

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INTRODUCTION

SAMARSKITE is a primary uranium mineral and is of rare occurrence. In India it has been reported from a few localities and in all cases, sporadically. The occurrence of this rare mineral in the mica-pegmatites of Nellore was reported by Tipper.[1, 2, 3]

The identification of this mineral by Tipper was apparently based only on its megascopic characters and qualitative analysis carried out by Blyth. Yajnik and Kohli[4] carried out determinations of radioactivity of some Indian minerals including samarskite. Samarskite and allied minerals offer analytical problems quite different from and considerably more difficult than those met with in the analysis of silicates. These minerals contain columbium and tantalum, several metals of the rare earths, thorium, titanium, zirconium, vanadium, uranium and some of the more common elements. Perhaps this accounts for the paucity of analytical data on the Nellore samples.

There are several interesting problems connected with samarskite. Euxenite is an alteration product and Smith[5] found that in North Carolina these two occur together. A closely allied mineral Hatchettolite has also been described by Dana (1876) and Smith (*loc. cit.*). No investigations appear to have been carried out in the Nellore area on the possible occurrence of these minerals. Further, samarskite contains several elements of the rare earth group and their identification and quantitative separation is of considerable interest. Finally since this mineral is primary, a determination of the uranium-thorium and lead ratio would enable a calculation of the age of the rock.[6]

In a previous note[7] the present authors pointed out that although accurate calculation of radium content of uranium minerals requires radioactivity measurements, an approximate figure could be obtained by calculation from the uranium content of an unaltered mineral by using the formula of Roberts,[8] *viz.*, % uranium $\times 3{\cdot}4 =$ mgm. of radium per ton. With the available data for the uranium-bearing silicate minerals, allanite and zircon (cyrtolite) these calculations were made and results reported

(*loc. cit.*) but as no analytical data was available on the Nellore samarskite, this could not be done for this mineral.

The object of the present paper is to report on the results obtained in our preliminary investigations on Nellore samarskites.

Samples

The samples of samarskite were secured from the Kodanda Rama mine in Nellore District. The mine is situated in a pegmatite vein having a strike of roughly N.N.W.-S.S.E. and almost perpendicular dip. The pegmatite is composed of large felspar and quartz crystals with books of mica. About sixty samples were collected from this mine and out of these, six representative samples were chosen for detailed investigation. The radioactivity of the samples was established by the photographic method.[7]

Megascopic Characters

The megascopic characters are given below in the table:—

Sample No.	Sp. Gr.	Hardness	Colour	Lustre	Streak	Cleavage	Fracture	Remarks
1	5·567	5	Dark steel grey	Vitreous	Dark-brown	Nil	Conchoidal	Intergrown with Columbite–Tantalite
2	5·570	6	Velvet black	Resinous	Brown	do	do	
3	5·677	6	do	do	do	do	do	
4	5·634	6	do	do	Reddish brown	do	do	
5	5·776	6	Black	Splendent	do	do	Uneven	
6	5·628	6	Velvet black	do	Dark-brown	do	do	Separated from Columbite–Tantalite

The above properties agree closely with those given by Dana[9] for samarskite. However, it should be noted that sample No. 1 is actually a coarse intergrowth of two minerals which are distinctly visible to the naked eye. Auto-radiographic evidence for this fact s reproduced below.

The auto-radiograph was taken by placing a polished surface in close contact with a panchromatic photographic plate covered with black paper and leaving them together in a dark cabinet for one week and developing the plate afterwards.

Fig. 1 is an actual photograph of the polished specimen and Fig. 2 is the corresponding auto-radiograph. Sample No. 6 was obtained from a specimen of samarskite intergrown with columbite-tantalite from which

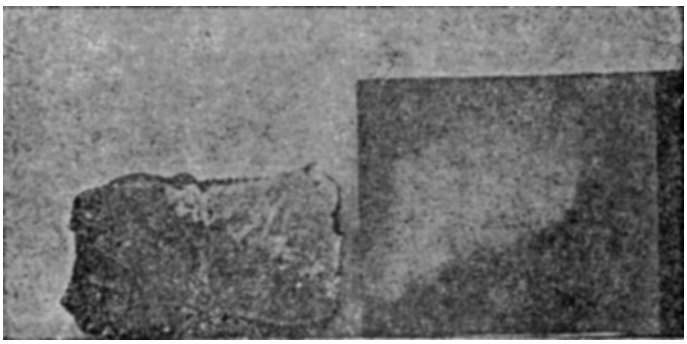

FIG. 1 FIG. 2

the non-samarskite portion was carefully separated. The columbite-tantalite minerals are closely associated with samarskite in this locality and it is not therefore surprising that the second mineral has been definitely identified as a columbite-tantalite by chemical analyses. It may be mentioned in passing that though there are small, normally insignificant, differences in properties among the samples, megascopically all of them appear to be samarskite.

CHEMICAL ANALYSIS

The samples were analysed primarily for their uranium content by the method described by Schoeller and Powell.[10] Uranium occurs in samarskite in both the quadrivalent and hexavalent states but their differentiation is not possible by this method of analysis. Hence the results are being reported in terms of UO_3 in the table below. Our results showed a greater degree of variation of UO_3 (5·6 to 10·5%) than those recorded by Swallow, Smith and Allen[9] for samarskite samples from N. Carolina, *viz.*, 10·9 to 12·5% UO_3. For comparison the mixed earth acid contents were determined approximately quantitatively by igniting and weighing the insoluble residue obtained by extracting the pyrosulphate melt with dilute hydrochloric acid.

Sample No.	UO_3%	Nb_2O_5 plus Ta_2O_5
1	4·2	69·7
2	10·5	54·3
3	6·1	59·2
4	8·7	54·0
5	5·6	58·4
6	8·4	53·4

This residue consists mainly of columbium and tantalum pentoxides contaminated by very small amounts of titania, stannic oxide, tungstic oxide, etc. The percentages of these minor constituents do not add to more than

two units. It is interesting to note that even in these values, there is divergence from the figures given by the authors referred to[9] (average value 55·3%). The divergence with the first sample is especially high but this can be readily explained as it is an intergrowth of two minerals, the other part being a columbite-tantalite. Sample 5 shows some difference in colour, lustre and fracture from pure samarskite but Sample 3 is a typical sample of this mineral. Megascopically these samples do not show any dissemination of another mineral.

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Summary

1. Sixty samples of samarskite were collected from a mica pegmatite vein in Nellore district, S. India.

2. The physical and chemical properties of six representative samples from this collection were studied.

3. Numbers 1 and 6 of the selected samples of samarskite were intergrown with Columbite-Tantalite.

4. The specific gravity of these six specimens varies from 5·567 to 5·776. The hardness is between 5 and 6. The colour varies from dark steel grey to velvet-black and the streak is generally brown to dark-brown. They all break with conchoidal fracture.

5. Specimen No. 1 which is an intergrowth of samarskite with Columbite-Tantalite was polished and placed in contact with a panchromatic photographic plate. Only the samarskite portion affected the photographic plate.

6. The chemical analysis of samarskite shows a variation in UO_3 percentage from 4·2 to 10·5% and the $Nb_2O_5 + Ta_2O_5$ from 53·4 to 69·7%. Attention is drawn to the fact that the UO_3 percentages of samarskite from the Nellore area differ from those of North Carolina.

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