URANIUM MINERALS OF INDIA*

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URANIUM is known to occur in about twenty minerals in India, some of which may contain it as the chief constituent while in others only a trace is present. It is desirable, therefore, to have knowledge of all the common uranium minerals whether of immediate commercial significance or not, because where one such mineral is found others are likely to occur nearby.

It is customary for geologists to classify these minerals as primary and secondary. Primary minerals are those that have not been changed since they were originally deposited, whereas secondary minerals are formed from the former by weathering or natural processes. The secondary ones may be different in appearance and may occur far removed from their origin. The primary minerals are usually found in vein deposits of pegmatites. They are dark brown or black, heavy and lustrous. The most important mineral of this class is pitchblende, essentially uranium oxide, which is the source of major uranium production in the Belgian Congo, Canada and Czechoslovakia. It is frequently found in association with sulphide ores of silver, cobalt, nickel and copper. Uraninite is another which has most of the characteristics of pitchblende but does not occur in considerable quantities except in association with pitchblende. Then, there are the uranium bearing oxides of tantalum, niobium and titanium, such as betafite, euxenite and samarskite which contain small percentages of uranium and have been worked to a limited extent in some parts of the world.

The secondary uranium minerals are characterised by bright yellow, orange and green colours and are usually present as powdery masses or groups of small crystals. They may occur in almost any type of rock either alone or with primary minerals, and have lower percentages of uranium. Carnotite is one such and has become commercially important in some foreign countries as a source of vanadium and radium. It may be bright yellow brown, grey or pale green depending upon local conditions. Autunite is bright lemon to yellow and invariably fluoesces under ultraviolet light. There are others such as torbernite but these are rare.

Occurrence

The occurrence of uranium minerals in some parts of India has been known as early as 1901.[1] The Geological Survey of India have done the early work in locating uranium deposits although no serious attempt had been made ,to ascertain the amount of uranium available in this country. The earlier chemical data cannot be relied upon as it has been specifically stated that "the analyses have no claim to great accuracy". During the past five years or so, many investigations have been conducted on the composition and age of uranium minerals, and the results have been reported in Indian Journals. However, there is no compilation which gives ready reference to all the existing sources of uranium in India, and in the following a thorough survey is made of the recorded occurrences of uranium minerals in India.

(1) Pitchblende[2,3] occurs in a pegmatite which crops out on a hill known as Akbhari Pahar in Gaya District, Bihar, rising 200 feet above the alluvium. The indications on the surface consisted of light yellow uranium ochre and as the pits were deepened, contained nodules of pure pitchblende. It occurs in Pichehli, Gaya District, in the felspar of the pegmatite and assayed to 66.34% of U_3O_8. It is also known to exist in Dhalbhum District. Prospecting in Bihar did not reveal a very large deposit.

(2) Uraninite[5] with other uranium minerals has been found in two localities in Singar Zamindari, Gaya District.

(3) Samarskite is known to occur in the Sankara mine, Nellore District, Madras, embedded wholly or partly in felspar, with small books of mica attached to it. It occurs in varying masses from minute crystals to several pounds in weight, although there were no indications of a continuous vein. In addition, Allanite[7] and two uranium-bearing minerals were also found in the locality. The mineral is also known to occur in Yedur, Bangalore District.[8]

(4) A tantaloniobate[9] of uranyl, iron and rare earths was found 5 miles to the west of

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*The Government of India have recently announced rewards for the discovery in India of deposits of uranium ore. The new deposits would have to be no less than 100 miles from those already known to the Indian Atomic Energy Commission. An award of upto Rs. 10,000 may be given if in the Government's opinion the new deposit is capable of producing 100 tons of uranium oxide in ore.

Vaiyampatti, Trichy District. The mineral was probably hatchettolite or endeiolite.

(5) A titanoniobate[3] of uranyl and rare earths, probably closely allied to euxenite, was found in Erania Taluq, Travancore.

(6) Uranium Ochre[3], usually encrusting pitchblende in Gaya District, has been noticed as rounded nodules in the felspar.

(7) Autunite[3] occurring as lemon yellow incrustations on some of the minerals, in Gaya District, was found to be less common and not crystalline.

(8) Torbernite[3] of bright green colour was found more in the same locality as encrusting mica, apatite and other minerals of the pegmatite and along cleavages in felspar.

(9) Sipylite[3] of red brown resinous lustre was detected with samarskite in Sankara mine and also was obtained from Ruzulapad mica mine.

(10) Gummite[10] has been discovered in Ajmer-Merwara, surrounding pitchblende, as red shells.

(11) Uranosphærite[11] has been found on the south side of Rewat Hill, Jodhpur.

(12) Uranophane[10] is recently reported to occur in Ajmer.

(13) Thorianite[9] was found as a perfect crystal in Travancore, and contained a high percentage of uranium oxide.

(14) Tantalite-niobite[12] found near Vaiyampatti when analysed contained uranium. In addition, traces of uranium are always found in monazite which might also be extracted by suitable methods.

Though these are the occurrences reported in literature, the Director, Geological Survey of India, observed as early as 1914 that "there seems to be no reason why uranium minerals should not be found at depths". With the impetus given in recent years by the atomic energy program, newer technique and instruments for prospecting have been evolved. These are described admirably in many governmental publications,[13-15] reference to which may also be made by Indian prospectors.

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1. *Memoirs, G. S. I* 1901, **34**, 31. 2. *Records, G.S.I.*, 1914, **44**, 24. 3 *Ibid.*, 1919, **50**, 255. 4. *Ibid.*, 1921, **53**, 297. 5. *Ibid*, 1921, **52**, 308. 6. *Ibid.*, 1911, **41**, 210. 7. *Ibid.*, 1920, **51**, 210. 8. *Ibid.*, 1930, **64**, 424, 9. *Ibid.*, 1917, **48**, 8. 10. *Jour. Sci. Ind. Res.*, 1948, **7**. 35. 11. *Records, G. S. I.*, 1922, **54**, 36. 12. *Ibid.*, 1918, **48**, 8. 13. 'Prospecting for Uranium," by the United States Atomic Energy Commission and the United States Geological Survey, 1949. 14 "Guide to Prospectors." by His Majesty's Stationery Office, London, 1949. 15. "Radioactive Mineral Deposits," by Bureau of Mineral Resources, Geology and Geophysics, Australia, 1948.

SYMPOSIUM ON THE HISTORY OF SCIENCE IN S. ASIA

THE Council of the National Institute of Sciences of India, in collaboration with the UNESCO South Asia Science Co-operation Office, propose to hold this winter in Delhi a Symposium on the History of Science in South Asia. It is expected that Dr. J. Needham, F.R.S., who is at present engaged in the writing of a History of Science in China, may come to India to participate in the Symposium.

It is proposed to constitute a study group for the Symposium with 15 scholars from within India and the adjacent countries, which will hold consecutive sessions for 3-4 days, where each scholar will present a paper on a specified subject, which will be discussed with particular reference to the impact of scientific knowledge on the problems of social organisation and human civilisation in general.

The following tentative agenda has been drawn up in order to give an idea of the scope of the Symposium which will cover the period up to the end of the 18th century.

1. (*a*) Chronology of the achievements; (*b*) Defining the periods of achievements; 2. Life stories of the pioneers; 3. Contacts with outside on countries' own initiative or by the adventurous trips of foreigners; 4. General history of those periods with stress on social conditions; 5. Impact of the discoveries of the scientists on military strategy of the kings and on the general living conditions like town planning, public health, agriculture, transport and industries.

Both historians and scientists are welcome to take part in the Symposium as it is expected that they will supplement each other's work and study.