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Origin and Distribution of Uranium and Thorium Deposits in India

Hydrothermal Deposits of Uranium:

During the early stages of the development of the uranium industry, plutonogenic hydrothermal deposits were of great economic significance. Such deposits are known from rocks of Proterozoic, Paleozoic, Mesozoic and Cenozoic age, and commonly occur as fissure filling type of veins. Metasomatic orebodies are rare. The deposits are usually found in areas of development of late geosynclinal and post-geosynclinal hypabyssal rocks with which they are genetically related.

1. Singhbhum District, Bihar: Uranium mineralization is confined to the more than 50 Km long Singhbhum Thrust, and is genetically related to the intrusive soda granite occurring marginally to the older Singhbhum Granite. At the Jaduguda Mine, about 26 Km south of Tatanagar, uranium occurs in comglomerates and quartz-chlorite-apatite-tourmaline rocks. Other deposits are located at Keruadungri, Bhatin and Narwapahar.
2. Sikar District, Rajasthan: The occurrence of brannerite with copper minerals at in the Archaean phyllites and schists intruded by granites at Khandela is an example of high intensity hydrothermal deposition.
3. Alwar District, Rajasthan: Torbernite, autunite and infrequent specks of pitchblende occur in the old copper workings at Kho-Dariba, where mineralization is confined to north-westerly high angle faults in the strongly folded phyllites, schists and arkosic quartzites. The mineralizing solutions appear to have emanated from the post-Delhi granitic intrusions in the area. The orebodies are mostly of the replacemet type.

Besides the above, a number of epithermal uranium vein deposits, poor in metallic sulfides occur in Udaipur distt. (Umra), and Jhunjhunu districts, Rajasthan; and in the Kulu district, Himachal Pradesh.

Syngenetic and Pegmatitic Deposits of Uranium:

1. Acid Intrusives and Extrusives: Almost all Precambrian granites and gneisses of granitic origin in Peninsular India are more or less radioactive. Thorium has a wider prevalence than uranium. Rich concentrations of metallic sulfides and/or uranium are not known in or around the peripheral parts of granitic plutons, but they sometimes occur at variable distances in structures in the surrounding host rocks.

   Among noteworthy occurrences, mention may be made of the Suryamalai Granitic Batholith in Salem District; radioactive patches around Gadwal, Mehboobnagar district, Andhra Pradesh; the Nayagaon-Khamor area, Udaipur District, Rajasthan; and the syenite outcrops near Samalpatti and Kumandapatti in Salem district.
2. Pegmatites: The most important source of syngenetic radioactive minerals is pegmatites formed by alkali-rich magmas. The deposits occur as lenticular orebodies upto a few hundred feet in length and as tabular bodies attaining lengths of about 3 miles and widths of upto 1400 feet. There is a better segregation and development of minerals in zoned pegmatites.

Uraninite occurs in pockets with cleavelandite feldspar in Bisundi Mine, Rajasthan; with beryl near Abraki Pahar, Bihar; and with lepidolite in Kadaval, Maharashtra. Monazite occurrs in many pegmatites in Bihar, Rajasthan, Andhra Pradesh, Karnataka and Kerala.

Uranium Deposits in Carbonatites:

Carbonatites are commonly considered as magmatic segregation deposits. They are carbonate rich rocks genetically related to the alkalic rock-forming process and alkali magma extrusion. Most carbonatites, especially those of Africa, contain valuable deposits of copper and other accessory minerals viz., niobium, rare earth elements, fluorocarbonates, phosphates and radioactive minerals.

Although carbonatites have so far not been found in India, two likely occurrences of these were reported, one at Ambadungar, Gujarat and the other at Newania, Rajasthan. The concerned rocks in both localities contain certain elements characteristic of carbonatites viz., Si, Fe, Ca, P, S, F, Cl, Ce, Ba, Sr and CO_2. At Newania, a highly folded calcareous granulitic rock containing calcite, chlorite, biotite, apatite, quartz and magnetite occurrs in a large post-Aravalli granitic intrusive. Radioactive minerals occur as spherical wort-like grains concentrated in the schistose minerals of the rock.

Placer Deposits of Thorium:

Some common minor primary constituents of igneous rocks carry uranium and thorium in isomorphous substitution for Ca, some REE and other elements. Monazite, apatite, zircon and sphene are some of the most abundant minerals belonging to this category. Most of these minerals are resistant to alteration, but they differ greatly in their resistance to attrition during their transportation with clastics. Monazite, apatite and xinotime are most easily reduced by attrition, but under favorable conditions these minerals become enriched in sands and gravels which have been transported short distances. They are found frequently in heavy mineral resistate fraction of terrestrially deposited clastics. Hence stream and beach monazite-bearing placers are found in many parts of the world. Zircon, which also carries a large portion of U and Th contents of felsic rocks, is a common constituent of the resistate fraction of all kinds of clastic sediments. These resistant minerals (monazite, apatite, xinotime and zircon) may be removed from erosional terranes of the igneous rocks and become concentrated in placer deposits in environments where rock destruction by decomposition is predominant over that by disintegration, viz. the tropical climatic zones.

The thorium content of the minerals contained in these placers is considerably greater than the uranium content; therefore the deposits are classified primarily as thorium-苑earing placers.

Monazite is the chief source of thorium in the world. Though it is a constituent of some granites and pegmatites, such sources are not economically workable. Monazite is concentrated by weathering into economically workable deposits in beach sands in the coastal tracts of Australia, Brazil, Ceylon, Malaysia and India. India possesses the largest deposits of monazite in the world. Recent indications are that in the near future, thorium would emerge as a fission fuel of greater potential than thorium.

In India monazite is found in the coastal tracts of Cuttak and Ganjam distr@ts of Orissa where the thickness of the placer is about 30 cm with a monazite content of 2.5 percent. Minor occurrences have been noticed between Chilka Lake and Chicacole River also.

In Andhra Pradesh thick ilmenite and monazite placers are found around Vishakhapatnam and Bhimunipatnam. The beach sands of the coastal tracts of Kerala and Tamil Nadu are also very rich in monazite. They also contain ilmenite and rutile. Monazite bearing sands are best developed along the beaches of the southwest coast of India between Quilon and Kanyakumari (Lipuram, Pudur, Kovalam, Varkala and Neendakarai) and between Chowghat and Ponnani. On the east coast of India, monazite concentrations are not as good as on the western and southwestern coasts, nevertheless small deposits are found along the Vishakhapatnam and Tanjore coasts. The monazite content of placers is rarely more than 3%. It appears that the maximum concentration of U and Th in placer type deposits are about 70 and 3000 ppm of sediment respectively, and the average concentrations are probably about 2 and 60 ppm respectively. Sands on the Florida coast are reported to contain 0.09% monazite, beach sands of India average 2-5% monazite.

Elsewhere in the country black sand deposits occur in the coastal tracts of Waltair, Bimlipatnam and Narasipatnam.

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