

Interregional IAEA-CYTED-UNECE Workshop

"Recent Developments in Evaluation of Uranium and Thorium Resources"

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THORIUM RESOURCES OF BRAZIL EXPLORATION HISTORY

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Ministério da
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INTRODUCTION:

- In earth crust the thorium is three to four times more abundant than uranium.
- Deposits of high grade thorium are scarcer than the uranium.
- Often, thorium substitute other elements in a large number of mineral complexes, such as tantalates and titano silicates.

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- The largest sources of thorium are deposits of monazite.
- Monazite usually contains 55 to 65% REO (Rare Earth Oxides) and 5 - 6% of ThO_2 . Monazitic sands contain up to 60% of monazite in localized concentrations.
- Monazite – phosphate anhydrous of rare earth.
cerium oxide - 39 to 40%;
thorium oxide - 0 to 18%;
zirconium oxide – 0 to 7%;
yttrium oxide - 0 to 5%.

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- Monazite - accessory mineral in different types of rocks: schist, gneiss, migmatite, diorite, granite and pegmatite.
- Primary Source: associated to metamorphism, medium to high degree, on clay sediments.
- Secondary Source: correlated to erosion of crystalline rocks, releasing the concentrations of monazite for transportation and accumulation in sedimentary rocks to finally be re-deposited on beaches and rivers environments (placers).

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EXPLORATION OF THORIUM ORES IN BRAZIL:

- Start in 1886, with the exploration of thorium as the main product - used in the manufacture of lamps.
- Electricity replaced the lamps so the rare earth became the main product and thorium a byproduct.
- After 1946 - possibility of thorium being used as nuclear material - main product in the exploration of monazite.
- In 1951 Brazil nationalized its deposits of monazite, restricting the output of thorium - rare earths became the main product and thorium a byproduct.

1951 – Implantation of three concentration plants in: Buena (RJ), Cumuruxatiba (BA) and São Paulo (SP).

1960 – CNEN acquires deposits of monazitic sands (coastal RJ, ES, BA) and the concentration plants of Buena, Cumuruxatiba and São Paulo.

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TYPES OF DEPOSITS:

Beaches Deposits: States Coasts of RN, BA, ES and RJ.

- 1 – Rio Grande do Norte: Cunhaú. Tibau;
- 2 – Bahia: Cumuruxatiba, Prado, Guaratiba;
- 3 – Espírito Santo: Tacareípe, Saue, Guaratiba;
- 4 – Rio de Janeiro: Salinas-Manguinhos, Tipiti, Guaxindiba, Largo e Atalhos.

Fluvial deposits

Are alluvial and elluvial deposits. Occur in the states of São Paulo, Minas Gerais, Rio de Janeiro, Espírito Santo, Bahia and Rio Grande do Norte.

Deposits in pegmatites

Occur in the states of Bahia, Minas Gerais and Goias.

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TYPES OF DEPOSITS:

Other Types of Deposits:

Morro do Ferro

Located in Plateau of Poços de Caldas (MG), magnetite dyke that cuts syenitic rock decomposed.

Uranium: 0.011 - 0.012%;

Thorium: 1.44 - 2.36%;

Rare Earth: 3 - 12%.

Alkaline Intrusions of Araxá

Located in the municipality of Araxá (MG). Thorium occurs associated with pyrochlore, as an accessory. The chemical analysis of pyrochlore (mineral pandaite) determined an average grade of 2.27% of ThO_2 .

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TYPES OF DEPOSITS:

Other Types of Deposits:

Thorianite of Amapá State

It occurs in placers and has the following composition: thorite, zircon, ilmenite and monazite. The chemical analysis of the concentrate determined a level of approximately 75% of ThO_2 .

Pitinga Mine

Located in the state of Amazonas. Explores cassiterite and columbite ores. Is a complex suite of Sn, Th, Nb, Ta, Y, U minerals, in an intrusive granite.

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Google Earth

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THORIUM RESERVES IN BRASIL:

Thorium sources – monazitic sands exploited to obtain rare earths, as the main product, and thorium oxide as a byproduct.

	Deposits	Measured Reserve *
Reasonably Assured Resources	1. Tipiti (RJ)	300
	2. Manguinhos (RJ)	80
	3. Boa Vista (ES)	300
	4. Guarapari (ES)	90
	5. Norte de Vitória (ES)	300
	6. Joacema (BA)	30
	7. Cumuruxatiba (BA)	250
Total		1350

* Tons of ThO₂, average content of 5% of ThO₂

Source: *Perfil Analítico de Tório e Terras Raras, DNPM, 1973*

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POTENTIAL SOURCES OF THORIUM:

Potential sources of thorium - alluvial monazitic sands, pegmatite, Morro do Ferro thorite, thorianite associated with pyrochlore of Araxá and monazite disseminated on continental sediments of Barreiras group.

Ocorrence	Ore	Average level*	Estimated Reserve *
Barreiras Group (ES)	Monazite	5%	2250
Morro do Ferro, Poços de Caldas (MG)	Thorite	1 - 2%	35000
Alkaline Intrusion of Araxá (MG)	Pyrochlore	0.09%	33000
Total			70250

* Tons of ThO₂, average level of ThO₂

Source: *Perfil Analítico de Tório e Terras Raras, DNPM, 1973*

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CONCLUSION

In recent decades, in Brazil, there was little or no action regarding to scientific and technological research directed on the use of thorium as a fuel element. This fact, associated with the global economic disinterest, resulted in lack of prospection and exploration of thorium ore and consequently little knowledge of its geology. This way, is justified the lack of an updated evaluation of the thorium potential in Brazil.

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Thank you for your attention!