TECHNOLOGY

# India's Atomic Future

**With the world's largest known deposits of thorium, India is staking her atomic future on this radioactive element, discovered by a German chemist on rope shipped from India.**

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➤ THE HEAVY BLACK SANDS along the southwest coast of India contain the world's largest known supply of thorium, nuclear fuel for industrial power.

Thorium, a radioactive element, is found there chemically bound to monazite, a phosphate of the group of elements known as rare earths. About one and a half million tons of monazite sands lie along the Travancore coast line, according to estimates by scientists at the Indian Rare Earths Limited. Indian monazite is especially rich in thorium, containing from eight to ten and a half percent.

Thorium ore has been found in Brazil, Indonesia, Malay, Florida, and in some parts of Russia, but the richest deposit lies on the cocoanut-fringed beach of India, about nine degrees north of the equator.

Along the narrow, hundred-mile strip of beach that stretches from Cape Comorin to north of Quilon, curious combinations of nature have worked for thousands of years to heap up the unusual supply of monazite sands.

Washed down from the crumbling Western Ghats by torrential monsoon rains, rich rare-earth minerals have gradually been carried westward towards the Arabian Sea. High specific gravity of these minerals causes them to sink quickly to the bottom, while lighter materials are borne away.

Considerable deposits of heavy mineral sands have in this way slowly moved onto the lower beaches of the country.

## Thrown Back on Beach

Under usual conditions of erosion they would be washed into the ocean and lost, but here unusual sea currents, sand-bar formations, and the yearly violent monsoon all combine to throw back the heavy sand grains. During the hot tranquil months of summer, silica grains make the beach blinding white under the sun. During the stormy monsoon months, however, southwestern winds whip the sea into churning waves that carry away lighter silica sands and heave black minerals back onto the low dunes.

It only remains for man to dig this sand during the monsoons and separate it into its various components.

The main constitutent of the black sand is ilmenite, a compound of iron and titanium oxides. Monazite, source of thorium, forms about three percent of the Travancore beach sand. Other minerals include rutile, zircon, and also sillimanite, garnet and quartz.

First stage in separating sands for nuclear fuel begins at the beach near Chawara, Quilon, where Indian factories separate thorium-bearing monazite from ilmenite by vibrating screens and electromagnetic separators.

From there, the now green-golden monazite sands, packed in gunny sacks, are poled in flat country boats along the Periyar River and shallow back waters to the Rare Earths factory at Alwaye about 30 miles to the north, where the second step for nuclear power takes place.

There, in modern gray and white buildings on a 24-acre site, more than 1,500 tons of monazite sands are treated chemically each year to produce rare earth compounds, shining white trisodium phosphate and the thorium residue, a light tan mud.

Alwaye officials estimate that the factory could treat well over 2,500 tons of monazite a year by working double shifts.

Most important to India's nuclear energy program is the residue thorium hydroxide, containing about nine percent thorium and a fraction of one percent uranium. This residue is shipped to Thrombay, near Bombay, to produce thorium and uranium compounds and metals for use in atomic reactors and industry.

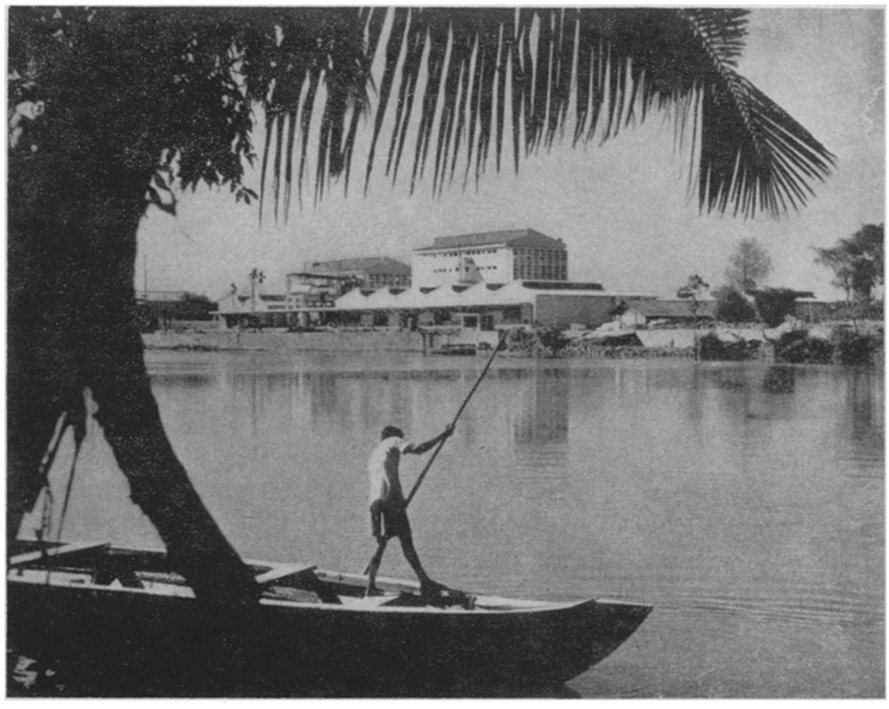
India will probably rely chiefly upon thorium for her future nuclear power, Indian scientists predict.

## Thorium Must Be Converted

Although thorium is radioactive, it is not naturally fissionable. It can be converted into U-233 which is fissionable. This is done in a breeder reactor where a core of U-235 sends out neutrons into a surrounding blanket of thorium and turns it into U-233, fissionable material for generating power.

This is the most likely process by which India will use her plentiful supply of thorium in her reactors.

The Indian Rare Earths Limited was set up in 1950, following the passage of the Government of India's Atomic Energy Act in 1948, and the establishment of an Atomic Energy Commission with Dr. Homi J. Bhabha as chairman. Dr. Bhabha, one of the world's foremost physicists, was chairman of the 82-nation Atoms-for-Peace Conference held at Geneva in 1955.



*ANCIENTS AND ATOMICS—An Indian riverboat in Travancore-Cochin is hand-powered past India's new rare earths factory, which is geared for the atom-powered future. Rich in thorium, India is scooping the radioactive element from her beach sands and processing it in this factory.*

India's valuable monazite deposits were discovered unexpectedly about 50 years ago by a chemist in a warehouse in Germany. In the early years of this century, coir, or rope, spinners were carrying on a lively trade with Europe, especially Germany. As coir spinners sat on the Travancore beach to twist their cocoanut-husk rope, heavy wet sand grains became entwined. Much of this sand fell off on the voyage, but some stuck long enough to reach the coir storerooms of Germany. In 1909 a German chemist chanced to analyze the yellow-green sands and found high quantities of monazite.

From then on, the beaches of Travancore were sifted, agitated, separated and exported without restriction until 1947 when a small group of scientists approached the president of the Indian Science Congress and convinced him to halt the foreign development of India's valuable minerals.

That president was Jawaharlal Nehru, and today the industry is under control of the Government of India, performing an important part in India's declaration of economic independence.

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CHEMISTRY

## Safe Substitute for Carbon Tetrachloride

➤ A SAFE SUBSTITUTE as a cleaning fluid for dangerous carbon tetrachloride exists in a little known solvent material, methyl chloroform.

It is much less likely to injure the user in almost every application where hand cleaning is done at room temperature, a committee of the American Industrial Hygiene Association in Detroit reported.

General ventilation is considered enough for brief exposures or those from use of very small quantities of the solvent. High temperatures or prolonged exposures will require process ventilation.

Recommended maximum atmospheric concentration (eight hours) for methyl chloroform is 500 parts of vapor per million parts of air (ppm) by volume, while that for carbon tetrachloride is 25 ppm, the industrial hygienists state.

A comparison of the two solvents shows their great similarity for cleaning purposes.

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TECHNOLOGY

## Photographic Lamp Safe In Dangerous Mines

➤ FOR UNDERGROUND PHOTOGRAPHERS in mines, even if they are gassy and likely to explode, there is a new floodlight that can be used for still and motion pictures without danger. The 1,000-watt unit, perfected by the Bureau of Mines Central Experiment Station in Pittsburgh, weighs only 25 pounds and looks like a movie studio lamp.

Science News Letter, November 10, 1956