Thorium

(Updated March 2

- **Thorium is much more abundant in nature than uranium.**
- **Thorium can also be used as a nuclear fuel through breeding to fissile uranium-233**

Thorium continues to be a tanatalising possibility for use in nuclear power reactors, though many years India has been the only sponsor of major research efforts to use it. Other endeavours include the development of the Radkowsky Thorium Reactor concept being ca out by US company Thorium Power (now Lightbridge Corporation) with Russian collaborati

In mid-2009, AECL signed agreements with three Chinese entities to develop and demonst the use of thorium fuel in the Candu reactors at Qinshan in China. Another mid-2009 agree between Areva and Lightbridge Corporation, was for assessing the use of thorium fuel in Areva's EPR, drawing upon earlier research. Thorium can also be used in Generation IV an other advanced nuclear fuel cycle systems.

Nature and sources of thorium

Thorium is a naturally-occurring, slightly radioactive metal discovered in 1828 by the Swedi chemist Jons Jakob Berzelius, who named it after Thor, the Norse god of thunder. It is foun small amounts in most rocks and soils, where it is about three times more abundant than uranium. Soil commonly contains an average of around 6 parts per million (ppm) of thorium

Thorium-232 (Th-232) decays very slowly (its half-life is about three times the age of the Ea but other thorium isotopes occur in its and in uranium's decay chains. Most of these are sh lived and hence much more radioactive than Th-232, though on a mass basis they are negligible.

When pure, thorium is a silvery white metal that retains its lustre for several months. Howev when it is contaminated with the oxide, thorium slowly tarnishes in air, becoming grey and eventually black. Thorium oxide (ThO_2), also called thoria, has one of the highest melting p of all oxides (3300°C). When heated in air, thorium metal turnings ignite and burn brilliantly a white light. Because of these properties, thorium has found applications in light bulb elem lantern mantles, arc-light lamps, welding electrodes and heat-resistant ceramics. Glass containing thorium oxide has a high refractive index and dispersion and is used in high qual lenses for cameras and scientific instruments.

The most common source of thorium is the rare earth phosphate mineral, monazite, which contains up to about 12% thorium phosphate, but 6-7% on average. Monazite is found in igneous and other rocks but the richest concentrations are in placer deposits, concentrated wave and current action with other heavy minerals. World monazite resources are estimate be about 12 million tonnes, two-thirds of which are in heavy mineral sands deposits on the and east coasts of India. There are substantial deposits in several other countries (see Tab below). Thorium recovery from monazite usually involves leaching with sodium hydroxide a 140°C followed by a complex process to precipitate pure ThO_2.