

## **The significance of the contemporaneous Shiva Impact Structure and Deccan Volcanism at the KT boundary**

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India was ground zero for two catastrophic events, the Shiva impact and Deccan volcanism at the KT boundary that have been linked to the dinosaur extinction. The buried and multiringed Shiva crater (~500 km diameter) on the western shelf of India is the remnant of a giant meteorite impact that left high-resolution stratigraphic signals in the sedimentary and volcanic rocks such as shocked quartz, iridium anomaly, nickel-rich spinels, sanidine spherules, magnetic nanoparticles, high pressure fullerenes, megatsunami deposits, and melt lavas. The Shiva crater is the largest hydrocarbon reserve in India, where the central uplift, the Bombay High, and the associated brecciated bodies and peripheral strata form ideal structural traps for oil and gas. The Shiva bolide (~40 km diameter) would generate lethal amount of kinetic energy of  $1.45 \times 10^{25}$  joules. The impact was so powerful that it led to several geodynamic anomalies: it fragmented, sheared, and deformed the lithosphere mantle across the western Indian margin and contributed to major plate reorganization in the Indian Ocean. It initiated rifting between India and Seychelles in the west and created the Laxmi Ridge; it shattered the Indian plate easterly along the Narmada-Son Rift extending 1500 km across, dividing the Indian shield into a southern peninsular block and a northern foreland block. Because of topographic barrier of the Western Ghat Mountain range, the impact-triggered tsunami was restricted along the Narmada-Son Rift at the KT boundary. The relationships between large meteoritic impact, hotspot, flood basalt volcanism, plate tectonics, geodynamic anomalies, and sudden environmental catastrophe on Earth may open up a new field of unified investigation. Although the Reunion hotspot responsible for Deccan eruption was close to the Shiva crater in time and space, impact probably triggered a component of the Deccan Trap: the iridium-rich alkaline igneous complex rocks that were emplaced asymmetrically as a fluid ejecta at the KT boundary along the NE downrange direction of the bolide trajectory outside the crater ring. Two large impacts such as Shiva and Chicxulub in quick succession on the antipodal position, in concert with Deccan eruptions, would have devastating effects globally leading to climatic and environmental catastrophes that wiped out dinosaurs and many other organisms at the KT boundary.