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Os isotope and platinum group elements indicate Late Cretaceous seafloor spreading in the Laxmi Basin, Indian Ocean

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Laxmi Basin in the eastern Arabian Sea, along the northern margin of the Indian Ocean, is considered of strategic significance for paleogeographic reconstruction because of its proximity to the locus of continental rifting and breakup of west Gondwana. There are competing hypotheses for its origin: as stretched continental crust, or as rift-related oceanic crust. Another variant is the suggestion that it is a stretched continental crust injected and covered by mafic volcanism as inferred from low seismic velocities in the middle crust. Laxmi Basin lies close to Deccan Flood Basalts along the western margin of India, which invited speculation for plume-rift connection and whether rifting pre- or post-dated the massive volcanism in Late Cretaceous. Resolving these hypotheses required direct sampling and geochemical investigation of the basement beneath. One of the objectives of International Ocean Discovery Program Expedition 355 is to determine the nature of the basement rocks in the Laxmi Basin. Drilling recovered ~8.72 m of massive basalt and associated volcaniclastic sediment at Site U1547. Post cruise geochemical analysis indicates that the basement is composed of low-K, high-Mg subalkalic tholeiitic basalts. Here we report our Os isotope and platinum group elements (PGEs) investigation of the igneous basement of Laxmi basin at Site U1547. Primitive mantle-normalized PGE concentrations display fractionated patterns akin to those of mid-ocean ridge basalts, but abundances are relatively elevated, probably owing to their variable but mostly less fractionated composition (MgO = 8.34-10.20 wt%). Re-Os dating indicates an age of 96 Ma for the oceanic crust, indicating that rifting and seafloor spreading predated the emplacement of Deccan Flood Basalts. Calculated initial $^{187}Os/^{188}Os$ ratios = 0. 2911-0.1662, with a trend to lower values toward the top of the cored basement. These ratios suggest up to 20-25% crustal contribution to mantle-derived magma composition. The Re-Os age is consistent with the culmination of seafloor spreading at 62.2-62.5 Ma based on seafloor magnetic anomalies southwest of Laxmi Ridge. The results suggest that the recovered basement rocks originated from post-rift seafloor spreading initiating at least as early as 96 million years ago.