

IODP insights on forearc destruction in Central America and its implications for the evolution of continents

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Integrated Ocean Drilling Program (IODP) Expedition 334 to southern Costa Rica documented unprecedented subduction erosion there. Central America drilling from Guatemala to Costa Rica has shown that subduction erosion was active at least since the early Miocene. In Southern Costa Rica, accelerated subduction erosion of the upper plate initiated when the Cocos Ridge, an over thickened aseismic ridge, arrived at the Middle America Trench. Accelerated subduction erosion was coeval with the rapid formation of deposition centers on the forearc of the upper plate. The completely recovered shelf sequence constrains a short (<2 Myr) interval of extreme subsidence (~1200 m) with a rapid pulse occurring during the first ~0.3 Myr. This event removed an estimated 1.2×10^6 km³ of forearc material at a rate of ~1690 km³/Myr/km of trench during a time of rapid (~1035 m/Myr) shelf sediment accumulation. At this erosive margin a sediment starved trench persisted, despite abundant sediment supply from onshore, because subduction erosion led to the rapid creation of fore-arc basins. Similar rapid pulses of subduction erosion may punctuate the evolution of many margins, contributing disproportionately to crustal recycling at subduction zones with implications for the evolution of continental crust and mountain belts, and recycling of continental material into the mantle.