

IODP Site U1513 volcanic sequence, Naturaliste Plateau: Implications on East Gondwana breakup

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Seismic reflection and dredging data indicate that extensive volcanism on and around the Naturaliste Plateau (NP) accompanied the Early Cretaceous rifting between Australia-Antarctica and Greater India during the breakup of East Gondwana. However, no direct stratigraphic evidence for this was available until IODP Expedition 369 drilled into the volcanic sequence for the first time at Site U1513 on the NP. The volcanic sequence consists of interlayered tholeiitic flows and volcanoclastic breccias, cut by multiple intrusions. Baked and depositional contacts between flows and breccias suggest that at least five phases of eruption took place. Petrological and textural evidence indicate subaerial to shallow water eruption. Shipboard geochemical data, verified by shore-based XRF analysis, imply geochemical affinity among Site U1513 flows, dredged NP basalts, and Bunbury Basalt flows in southwest Australia. Primary magma derived from the most primitive basalts (high MgO, Ni, and Cr) from Site U1513 has $Mg\# = 0.77$ and equilibrium olivine forsterite content of 92%. Modeling suggests generation by 20% partial melting at 1.5 GPa and mantle potential temperature of 1398°C, indicating a more fertile than normal ocean ridge mantle source. Magnetostratigraphy support contemporaneous emplacement of Site U1513 basalts with the oldest Bunbury Basalt flows and a link with initiation of spreading in the Perth Abyssal Plain, southeastern Indian Ocean.