Enriched gabbro sills (~30m) intruded into post-16Ma sediments and deeper medium-grained gabbros to cryptocrystalline basalts (>150m) were cored on ODP Legs 170 and 205 (9°39'N, 86°11'W) on the Cocos plate near Costa Rica. Magnetic anomalies indicate that the basement is EPR lithosphere (Barckhausen et al, 2001). The units studied here may be related to overprinting by the Galapagos hotspot, consistent with the site’s paleolocation.

The rocks are low- to medium-K (K<sub>2</sub>O < 0.44wt%) subalkaline tholeiities with SiO<sub>2</sub> 46-50wt% and Mg#= 0.44-0.60, similar to Leg 206. Major and minor element variations are consistent with previous fractional crystallization of olivine, plagioclase, Fe-Ti oxides, ± augite; discrete alteration is 1-5vol%. The small ranges in major and compatible elements largely reflect phase equilibria control, rather than source differences. However variations in incompatible trace element ratios are best interpreted in terms of two distinct magma batches with slightly different mantle sources.

On a plot of Sr-Nd isotopes, Leg 205 samples (143Nd/144Nd = 0.512937-0.513020 ±8, 87Sr/86Sr = 0.703245-0.705106 ±10) overlap the range of Galapagos Island basalts rather than EPR, except when 87Sr/86Sr > 0.70400. Elevated 87Sr/86Sr is likely a result of alteration, although leachates have not yet been analyzed. The Nd-isotopic ratios cluster near 0.512950 (one value extends to 0.513020) and good correlation between the Sr-Nd isotopes of less-altered samples suggests mixing between mantle domains of variable enrichment. Rocks from Leg 205 record enrichment within EPR-generated lithosphere and may be the most northerly expressions of the Galapagos hotspot.

REE patterns for Leg 170 samples form 2 distinct groups, both overlapping ranges of the Galapagos Islands and regional spreading centers (EPR and Cocos-Nazca spreading (CNS) center). The two groups (Grp 1 LREE ~60x chondrites; Grp 2 ~32x, both with HREE ~16x chondrites) may correlate with depth, but their differences cannot be explained by fractional crystallization alone. Consideration of HFSE systematics and REE abundances suggest that mixing between heterogeneous sources and differing degrees of partial melting are required to generate these two groups.
On a plot of Hf/Ta vs. (La/Sm)$_N$, CNS and EPR lavas (Hf/Ta $>$10, (La/Sm)$_N$ $\sim$0.5-1.5) are well separated from Galapagos lavas (Hf/Ta $<$5 and (La/Sm)$_N$ $\sim$1-2.5). Leg 170 rocks are within the Galapagos field, as are samples from the 14Ma Fisher Seamount SW of the ODP sites. The origin of igneous units from Leg 170, and by association Leg 205, is best explained as 10-20% degree partial melting from a mantle source $<$30% enriched compared to regional depleted mantle.

Mantle mixing between the Galapagos hotspot and the nearby EPR and CNS ridges is recorded in off-axis volcanism offshore Costa Rica. Trace element and isotope results suggest that the spatial and geochemical influence of the Galapagos hotspot is more extensive than previously recognized, and may form a significant part of the oceanic section subducting off Costa Rica, a NSF-MARGINS focus site for studies of crustal recycling at convergent margins.