Earliest stages of formation of oceanic lithosphere in the central Atlantic Ocean: The oceanic plate beneath the Canary Islands

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The Canary Islands form a roughly east-west trending chain normal to the coast of Africa. The base of the continental slope lies only 30-40 km east of the coast of the easternmost island, Fuerteventura. The oceanic lithosphere beneath the Canary Islands formed about 180-150 Ma ago during the earliest stages of opening of the central Atlantic Ocean. The Canary Islands hotspot has been active during the last 60-70 million years. Through point analyses of trace elements and $^{87}Sr/^{86}Sr$ isotopic ratios in minerals in deep crustal and upper mantle xenoliths, one can "see behind" the effects of the Canarian magmatic event, to the original composition of the underlying oceanic plate. This is best preserved in the REE concentrations in the most refractory olivine and orthopyroxene porphyroclasts, which are strongly depleted in MREE relative to HREE. LAM-MC-ICPMS Sr isotope analyses of clinopyroxenes in mildly metasomatised spinel harzburgite xenoliths give $^{87}Sr/^{86}Sr$ ratios of 0.7027- 0.7028, within the range of N-MORB and significantly below the range of Canarian magmatic rocks. Modeling based on major and trace elements suggests that the oceanic lithospheric mantle beneath the Canary Islands represents the residue after about 25% depletion relative to the Primordial Mantle. The lower crust consists of highly refractory tholeiitic gabbros that have reacted with Canarian alkaline magmas to different degrees. The lowest degree of metasomatism is found in gabbro xenoliths from Fuerteventura. Estimates based on the REE compositions of clinopyroxenes in these rocks suggest formation from melts with $(La/Sm)_N$=0.16 and $(Sm/Yb)_N$=0.52. These ratios are among the lowest ones recorded for MORB magmas and suggest by partial melting of a mantle source that had already undergone at least 12-15% depletion relative to Primordial Mantle. Composition of the lithospheric mantle beneath the Canary Islands is thus in agreement with an origin as the residue after formation of the oceanic crust in the area. We have found no east-west changes in mantle composition. The continent-ocean transition in the area of the Canary Islands appears to be quite sharp, unlike the wide continent-ocean transition zones found in the Iberia Abyssal Plain and in the Red Sea.