JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 105, Number B3, PAGES 5859-5885, MARCH 10, 2000

Deep structure of the ocean-continent transition in the southern Iberia Abyssal Plain from seismic refraction profiles: The IAM-9 transect at 40°20'N

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Abstract. We present a crust and mantle velocity structure for the West Iberia passive continental margin derived from a 320-km-long wide-angle seismic profile acquired in the southern Iberia Abyssal Plain. We observe a 170-km-wide ocean-continent transition zone which includes a pair of overlapping peridotite ridges and is bounded by oceanic crust and landward by fault-bounded blocks of continental crust. The profile lies ~40 km south of the transect sampled by Ocean Drilling Program (ODP) Legs 149 and 173. The transition zone structure can be divided into an upper layer, 2–4 km thick with velocities of between 4.5 and 7.0 km s^{-1} and generally a high-velocity-gradient (1 s^{-1}), and a lower layer up to 4 km thick with a velocity of ~7.6 km s^{-1} and a low-velocity-gradient. A weak Moho reflection in this zone was seen only on wide-angle profiles at an offset of ~30 km. The upper layer has a distinctly lower velocity than thinned continental crust adjacent to the continental slope. Conversely, the lower layer has too high a velocity to be magmatically intruded or underplated lower continental crust. On the coincident seismic reflection profile, fault-bounded crustal blocks, identified in unequivocal extended continental crust, are not observed in the transition zone. The upper layer has velocity bounds and gradient similar to oceanic layer 2 observed west of the peridotite ridges, but no oceanic layer 3 velocity structure is present. While magnetic anomalies have been identified within the transition zone, they have not been modeled successfully as seafloor spreading magnetic anomalies, nor do they generally form long linear margin-parallel features. Finally, ODP boreholes, ~40 km north of our profile and within the interpreted transition zone, have recovered up to 140-m-thick sections of serpentinite and serpentinized peridotites with little evidence of mafic igneous material. We conclude that the transition zone cannot be dominantly composed of either extended continental crust or oceanic crust. Although current melting models predict a considerably thicker crust of decompression melt products, we interpret this region as exposed upper mantle peridotite with little or no synrift extrusive material and limited amounts of synrift material intruded within the serpentinized peridotite.

1. Introduction

The study of the structure and composition of passive continental margins provides an insight into the mechanisms of continental rifting and its evolution to seafloor spreading. Continental rifting involves a combination of tectonic and magmatic processes. Tectonic models have broadly concentrated on the relative contributions of pure and/or simple shear in the lithosphere. Magmatism during rifting is principally dependent on mantle temperature, rate and duration of extension, and the initial lithospheric thickness [*Bown and White*, 1995]. Continental margins have been divided into one of two types depending on the apparent

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Paper number 1999JB900301.
0148-0227/99/1999JB900301$09.00