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Review Article

Crustal structure variations along the NW-African continental margin: A comparison of new and existing models from wide-angle and reflection seismic data

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ABSTRACT

Deep seismic data represent a key to understand the geometry and mechanism of continental rifting. The passive continental margin of NW-Africa is one of the oldest on earth, formed during the Upper Triassic–Lower Liassic rifting of the central Atlantic Ocean over 200 Ma. We present new and existing wide-angle and reflection seismic data from four study regions along the margin located in the south offshore DAKHLA, on the central continental margin offshore Safi, in the northern Moroccan salt basin, and in the Gulf of Cadiz.

The thickness of unthinned continental crust decreases from 36 km in the North to about 27 km in the South. Crustal thinning takes place over a region of 150 km in the north and only 70 km in the south. The North Moroccan Basin is underlain by highly thinned continental crust of only 6–8 km thickness. The ocean–continent transition zone shows a variable width between 40 and 70 km and is characterized by seismic velocities in between those of typical oceanic and thinned continental crust. The neighbouring oceanic crust is characterized by a thickness of 7–8 km along the complete margin. Relatively high velocities of up to 7.5 km/s have been imaged between magnetic anomalies S1 and M25, and are probably related to changes in the spreading velocities at the time of the Kimmeridgian/Tithonian plate reorganization.

Volcanic activity seems to be mostly confined to the region next to the Canary Islands, and is thus not related to the initial opening of the ocean, which was associated to only weak volcanism. Comparison with the conjugate margin off Nova Scotia shows comparable continental crustal structures, but 2–3 km thinner oceanic crust on the American side than on the African margin.

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1. Introduction

The Moroccan margin formed during initial rifting of the Atlantic is one of the oldest passive margins in the world. Its deep structure is still less well know than that of its conjugate, the Nova Scotian Margin (Funck et al., 2004; Keen and Potter, 1995a,b; Luheshi et al., 2012). During rifting three major salt basins were formed along the margin. After rifting and the onset of sea floor spreading, the convergence between the African and Eurasian plates leading to the buildup of the Atlas mountain system in Eocene times was recorded in the structure of the

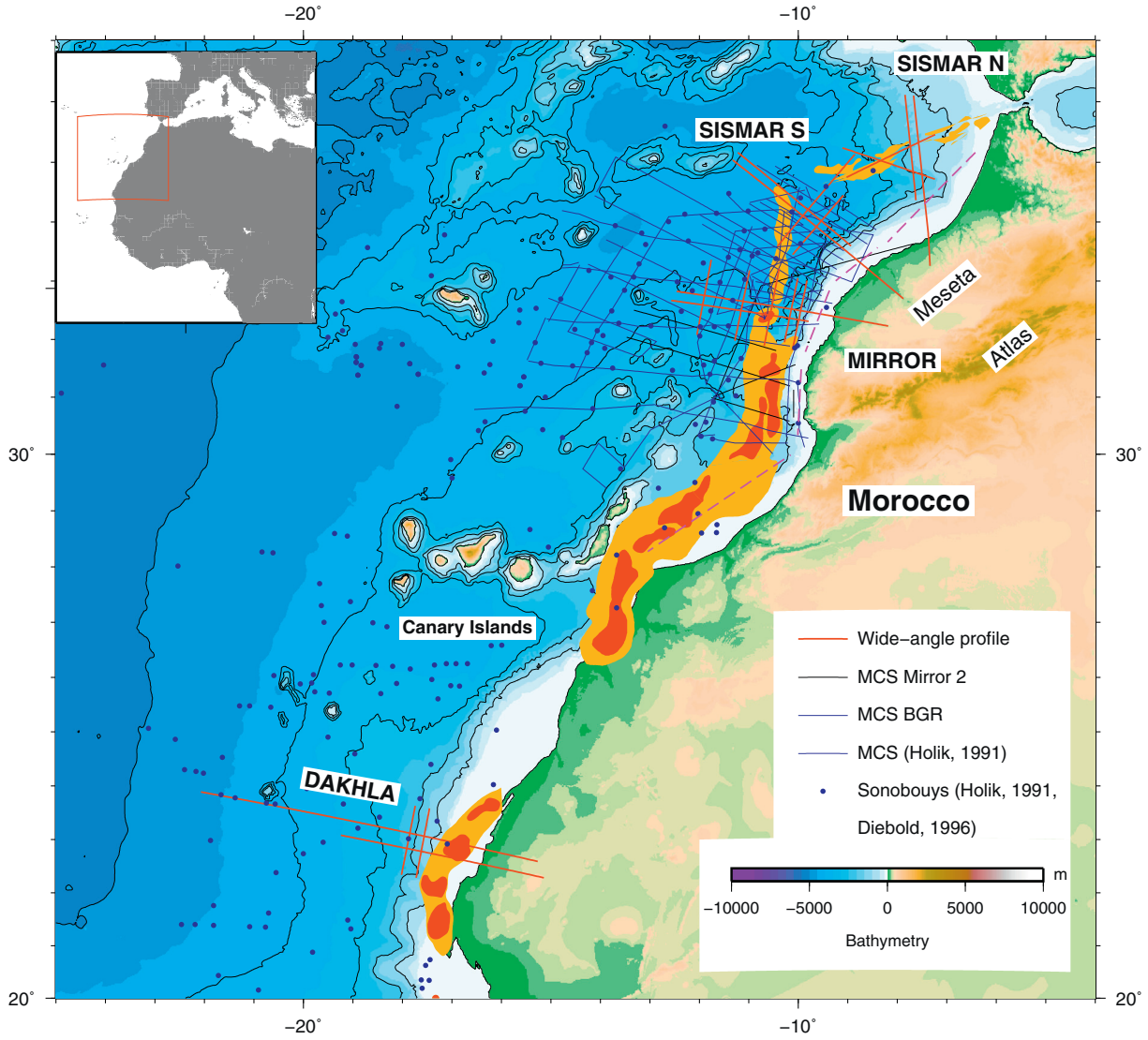

Fig. 1. Seafloor bathymetry and topography from the ETOPO data set (Smith and Sandwell, 1997). Location of the wide-angle seismic profiles acquired during the SISMAR, DAKHLA and MIRROR cruises. The WACMA magnetic anomaly which marks the initial opening of the ocean is shown by orange and red outlines depending on their amplitude, with red representing the higher amplitudes.

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