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The transmission from rifting to seafloor spreading: magnetic slope off Morocco

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In many cases, passive continental margins are paralleled by a prominent magnetic anomaly, the so-called 'slope anomaly'. Off the Atlantic coast of Morocco, the slope anomaly (named S1) varies considerably along the strike in amplitude and shape (Fig. 1). The variations are correlated to changes in the magnetic character of the subsided and fractured continental crust eastward of the slope anomaly where lineated magnetic anomalies, nearly parallel to S1, were observed. Seaward of S1 the anomalies are generally much weaker. They are also parallel to the slope anomaly, however less continuous.

The change of the magnetic signature at S1, and the fact that it is the strongest anomaly, indicate that it marks the continent–ocean boundary. This is supported by the reflection seismic data which shows oceanic character for the crust seaward of the slope anomaly. Over the slope anomaly itself the reflectors reveal a most irregular pattern. Landward diapiric structures dominate the continental slope. The most prominent of these 'diapirs' coincides with a magnetic anomaly. Due to model calculations the source body must lie within the structure.

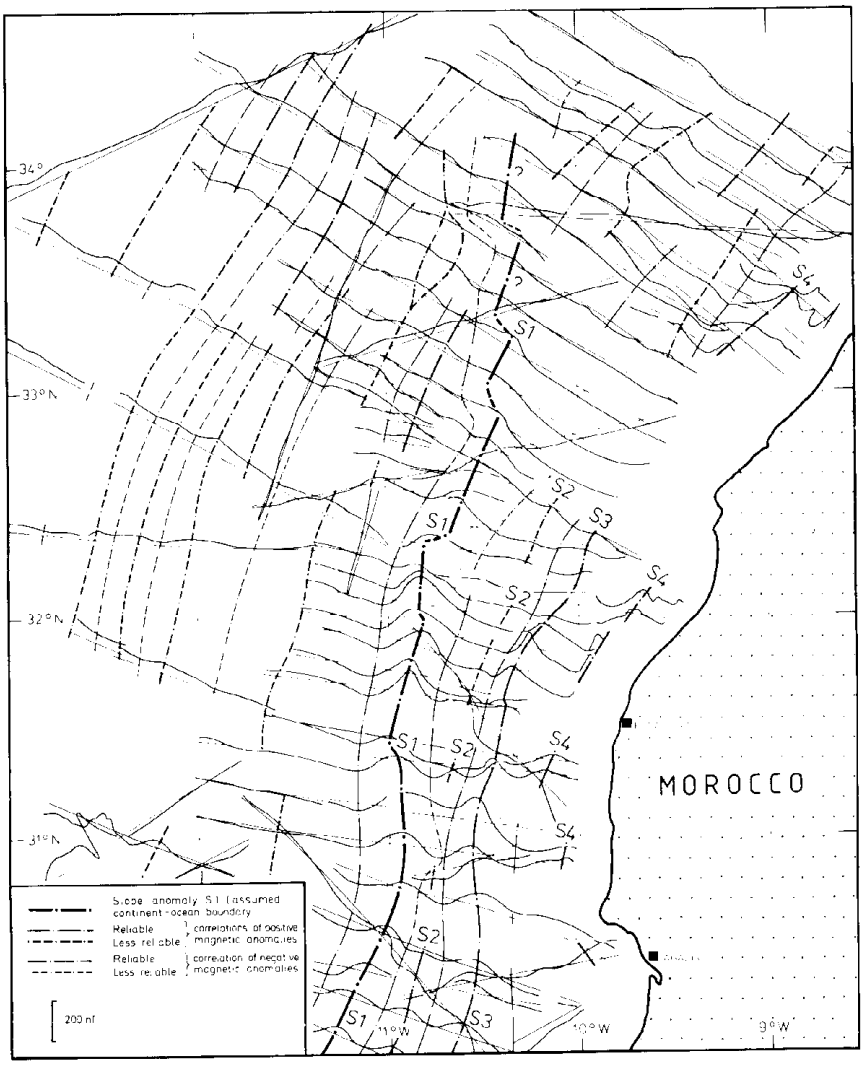

Fig 1 Total intensity anomalies of the earth's magnetic field around the Atlantic continental margin of Morocco.

S1 cannot be interpreted as an edge effect. Instead a body with high magnetization is necessary. Refraction seismic measurements resulted in velocities of 7 km s^{-1} and 8 km s^{-1} at shallow depth at the place of the required body. Thus the crust is neither continental nor typically oceanic in character. It may be interpreted as a seafloor spreading crust influenced by the cold continental crust adjacent to the rift at the beginning of the drift phase.

Similar conditions exist at large-offset fracture zones where the mid-ocean ridge abuts cooler oceanic crust. Often the magnetization is lower at fracture zones than for typical oceanic crust; in some cases it is higher. Likewise at many continental margins magnetic slope anomalies are not observed. The existence, or lack of, a magnetic slope anomaly might provide important insights into the processes governing the beginning of seafloor spreading.