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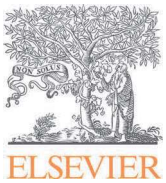

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New evidence of Late Cretaceous magmatism on the offshore central West Iberian Margin (Estremadura Spur) from potential field data

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ABSTRACT

The West Iberian Margin (WIM) is a key example of a magma-poor passive margin, punctuated by several post-rift magmatic manifestations that are part of the Late Cretaceous Atlantic Alkaline Province. In this work, potential field (gravity and magnetics) data, constrained by 3D multichannel seismic reflection data, are used to describe and characterise the geometry and nature of magmatic features located offshore the central segment of the margin, the Estremadura Spur. The estimated geometry and nature of the magmatic features was achieved through the integration of 3D gravity and magnetic inversion and 2D magnetic forward modelling. The results provide an insightful 3D subsurface model revealing that: 1) the Estremadura Spur Intrusion represents a 28 × 15 km wide laccolith with an overall granitic nature and an estimated density of 2490–2640 kg/m^3 and 0.01–0.05 SI magnetic susceptibility, 2) the 26 × 17 km Fontanelas buried volcano is dominantly basaltic, with density values of 2500–2821 kg/m^3 and magnetic susceptibility of 0.01 to 0.0875 SI, and 3) multiple sill complexes intruded the region, thus producing a higher magnetic background on otherwise inconspicuous anomalies The models allowed achieving a confident fit suggesting that both the ESI and the Fontanelas volcano are coeval with the outcropping magmatic features from this same magmatic event. Additionally, the results support that Late Cretaceous alkaline magmatism on the West Iberian Margin is more significant than anticipated and provide further evidence to clarify unclear geometrical aspects of similar intrusions observed onshore. Acknowledging the geometry and nature of these magmatic entities allows to better understand the role of post-rift intra-plate magmatism on continental hyper-extended rifted margins by clarifying how shallow plumbing systems evolve in these settings.

1. Introduction

Volcanism is the most visible and compelling evidence for the existence of Earth's internal energy, which nowadays translates into an Earth's global surface heat flux of 44–47 TW (Davies, 2013, and references therein). Most of the internal heat of the Earth is produced/stored in the mantle (Lay et al., 2008), the largest (83%) and heaviest (67%) reservoir of the planet. Mafic magmatism provides the best testimony of the mantle to crust heat and mass transfer. However, only a small proportion (probably <10%; Putirka, 2017) of the mantle magmas erupt, rather crystallizing as intrusive bodies. The assessment of the volumes and forms of such intrusive formations is important to the full characterization of a magmatic province.

The hyper-extended West Iberian Margin (WIM; Fig. 1) was generated in relation with the rifting and drifting processes associated with the opening of the Atlantic Ocean (e.g., Sutra et al., 2013; Tucholke and Sibuet, 2007), and represents a singular case of mantle-crust interaction with post-rift magmatism punctuating specific sectors of the hyper-extended continental margin (Fig. 1A). These intra-plate post-rift alkaline magmatic manifestations of Late Cretaceous age are part of the wider Atlantic Alkaline Province (Merle et al., 2019). Namely, at the onshore of the WIM, magmatic occurrences are well known and include,

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