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# Late Cretaceous post-rift magma emplacement offshore the West Iberian Margin

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The West Iberian Margin is a prime example of a magma-poor hyperextended continental margin. However, the margin is punctuated by three discrete Mesozoic magmatic events, from which the last, occurring 20-40 M.a. after complete lithospheric breakup of the Iberia-Newfoundland conjugate margin, is related to the late Cretaceous Atlantic Alkaline Province. It is characterised onshore by multiple outcropping intrusive (Sintra, Sines and Monchique) and extrusive (e.g., the Lisbon Volcanic Complex) alkaline suites of magmatism, and offshore by conspicuous and enigmatic magnetic anomalies, suggesting additional magmatic features.

Analysis of seismic reflection and potential field data, from the offshore central segment of the West Iberian Margin, unveiled the evidence of a complete intraplate magmatic plumbing system, comprising the presence of a large intrusive feature, a preserved volcanic edifice with its related lava flows, and the associated network of sills and sill complexes. The intrusive body, the Estremadura Spur Intrusion, is revealed to correspond to a sizeable laccolith of about 530 $km^3$ of rock volume, for which 3D gravity and magnetic inversion and 2D magnetic forward modelling, constrained by seismic data, suggest a composition predominantly granitic. The Fontanelas volcano, cropping out the seafloor and partly buried by latest Cretaceous and Tertiary sediments, is a 2800 m high volcano showing different summits. Internal architecture of the volcano, showing outward dipping reflectors that can be assigned to lava flows and explosive debris, reveals that the composite edifice has grown progressively from multiple vents. Potential field data models suggest the edifice is predominantly of basaltic nature, an aspect supported by previous dredge samples collected at the crest of the volcano, that yielded remnants of basic pillow lavas and hyaloclastites. Additionally, our analysis revealed the presence of two exceptionally well imaged distinct events of extrusive magmatism. The first, preceding the build-up of the volcanic edifice reveals multiple and superimposed fan-shape to tabular crenulated submarine sheet or ‘a'ā lava flows, sourced from a fissure-type feature located SE of the Fontanelas volcano. A second group of lava flows directly associated with the final stages of volcanic build-up, comprises dendritic and lobate lava flows (pahoehoe or submarine flows) blanketing the flank of the edifice. Associated

with these magmatic features, numerous sills and sill complexes, characterised by distinct planar to saucer-shaped geometries, comprise the remaining elements of the plumbing system.

Our analysis indicates that syn-rift structural inheritance has controlled the locus and tectono-magmatic emplacement of these features piercing the thinned continental crust, that occurred in two pulses: 1) Coniacian-lower Campanian and 2) mid to late Campanian. Moreover, the evidence of a vigorous plumbing system offshore the West Iberian Margin bears implications on models involved in mantle upwelling feeding the Atlantic Alkaline Province since the late Cretaceous, pointing to massive mantle to crust magma transfer tentatively assigned to a resilient mantle plume rooted at the Central-East Atlantic Anomaly.

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