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Late Cretaceous sub-volcanic structure in the continental shelf off Portugal and its implications on tectonics and seismicity

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Long-lasting and widespread alkaline magmatism is recognized in the west Portuguese margin. Offshore, several volcanic seamounts punctuate the Tore-Madeira Rise and the Estremadura Spur, with known ages between 80 and 100 Ma. Onshore, the major events are the Monchique (69-73 Ma), Sines (75-77 Ma) and Sintra (75-82 Ma) plutons – whose location (aligned along 200 km) and age discrepancy inspired some geodynamic models for Iberia during the Cretaceous – and the Lisbon Volcanic Complex (90-100 Ma). Structural links between them have been proposed but no direct evidence was yet found for it.

In this work we present new magnetic data from recent marine magnetic surveys (ROCHEL and MINEPLAT project) conducted off the west Portuguese coast on the continental shelf and slope. A total area of about 3000 km2 between Sintra and Sines was surveyed with line spacing of 1 mile. Very high-resolution multi-channel seismic profiles were simultaneously acquired with the magnetics covering an area of ∼400 km2 off Sines. Two main primary outcomes arise from these data. On one hand, higher-resolution mapping in regions where magnetic anomalies were already known allows a better understanding of the buried sub-volcanic system. On the other hand, previously unknown NNW-SSE aligned magnetic anomalies were identified along the coast off Sines, possibly corresponding to buried Late Cretaceous alkaline magmatic intrusives. The presence of magmatic bodies was up to now unknown in this region, and these findings reignite the discussion about a structural link connecting the three main on land intrusive complexes, Sintra, Sines and Monchique. In addition to the structural control of the magmatic complexes, seismicity is also an issue as a cluster of seismicity coincident with the Monchique complex has long been known. Smaller clusters coincide with the magnetic anomalies mapped during the ROCHEL and MINEPLAT surveys, as well.

We interpret these results in the light of the tectono-magmatism of West Iberia during the Late Cretaceous and at Present, specifically: What was the tectonic control for the emplacement of these magmatic bodies emplaced on the rifted margin? Is the rheological contrast between magmatic bodies and host-rocks controlling the seismicity localization?

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