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Overlapped magnetic anomalies: a key to understand the structure of the South Iberian convergent margin

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The Iberian Massif is part of the Variscan belt and constitutes the relatively stable Betic Cordillera foreland, which extends below the Guadalquivir foreland basin and beneath the External Zones of the cordillera. The Ossa Morena Zone, belonging to the Iberian Massif, is mainly formed by Precambrian and Devonian preorogenic rocks affected late Paleozoic metamorphism and ductile deformation with NW-SE orientation. A band of amphibolites with oceanic affinity, the so-called Beja-Acebuches Amphibolite unit, marks its southern boundary. The External zones of the Betic Cordillera correspond to the Mesozoic South Iberian Margin, mostly composed by carbonate sedimentary rocks. The Subbetic Lias series include basic volcanic rocks; its pillow-lavas structure discloses its submarine emplacement. This region correspond to the alpine fold and thrust belt of the frontal part of the Betic Cordillera.

Geophysical data are essential to reveal the main crustal deep structures in areas where geological surface observations do not provide enough detailed data. Magnetic anomalies studies help to constrain the structure of intermediate and basic igneous rocks. The main magnetic anomalies in the southeastern Spain are related to both Alpine and Variscan geological structures. The aeromagnetic anomaly map of the Iberian Peninsula shows two orientation patterns for the magnetic dipoles. The Variscan anomalies elongate in NW-SE direction whereas the Subbetic Cordillera dipoles overlap the former with NE-SW trend. Magnetic surveys carried on to determine the position and geometry of intermediate igneous intrusive bodies responsible of the magnetic anomalies in the Subbetic Zone of the Betic cordillera. Simultaneous modelling of aeromagnetic and field magnetic anomalies together with the integration of magnetic susceptibility measurements and geological data allow defining the basic Subbetic bodies as well as quantifying the influence of the Variscan basement anomalies. The Subbetic anomalies are consequence of lenticular and discontinuous Jurassic basic volcanic bodies aligned in N70ºE direction. They emplaced in the initial stages of the continental crust fracturing, during the opening of the Tethys. This study stands out the remaining of the volcanic structure alignment despite the later alpine deformation. The absence of any magnetic deep evidence of a major fracture in the underlying Iberian Massif basement suggests that the present-day orientation is consequence of the rotation of the detached Subbetic units including the initial roughly N-S volcanic structures during alpine margin convergence.