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Guadiana fault: magnetic and gravity constraints related with the Monchique Alkaline Complex structure (Betic Cordillera foreland)

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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 us to constrain the structure of intermediate and basic igneous rocks. Magnetic and gravity surveys have been combined to determine the geometry, position and properties of intermediate igneous intrusive bodies responsible of the magnetic anomalies in the western area of the Betic Cordillera foreland. Furthermore, crustal structure has been characterized revealing the presence of a blind fault: The Guadiana fault.

The aeromagnetic data reveal that the southwestern Iberian Peninsula is characterized by an elongated E-W dipole extending 200 km towards the Betic Cordillera external zones. The anomaly is related to the outcropping Monchique Alkaline Complex, characterized by rocks of moderate magnetic susceptibility (0.029 SI) intruding into the metapelitic host rock of the South Portuguese Zone. In this region, new total field magnetic data has been acquired with a GSM 8 proton precession magnetometer with an accuracy of 1 nT at a mean height of 2 m above the topography. Susceptibility measurements were done with an Exploranium KT-9 kappameter.

Combined analysis of aeromagnetic and field magnetic anomalies serves to constrain the depth and geometry of this laccolith. Toward the east, the magnetic dipole has a 60 km long N-S sharp step that coincides with the southern part of the Guadiana River (Spain-Portugal southernmost border).

In addition, gravity measurements were performed simultaneously with the magnetic data acquisition using a Scintrex Autograv CG-5 gravity meter whose maximum accuracy is 0.001 mGal. This data support the presence of this major discontinuity in the elongated anomalous body, with an E downthrown block, interpreted as the offset produced by a deep N-S crustal fault - The Guadiana Fault.

Therefore, the Guadiana River has three long linear segments near its mouth, locally coinciding with a N-S trending joint set, that support the presence of this structure. To date, no evidence of this tectonic discontinuity, coinciding with the Spanish-Portuguese border, has been reported. Magnetic research is essential for understanding the structure of wide regions intruded by intermediate and/or basic igneous rocks.