# New paleomagnetic study on Jurassic Gabbroic Rocks from the Central High Atlas (Morocco): structural implications

Pablo Calvín[1], Vicente Carlos Ruiz-Martínez[2], Juan José Villalaín[1], Antonio Casas-Sainz[3] , Bennacer Moussaid[4]

[1] Departamento de Física, Universidad de Burgos, Spain
[2] Departamento de Geofísica y Meteorología, Universidad Complutense de Madrid, Spain
[3] Departamento de Ciencias de la Tierra, Universidad de Zaragoza, Spain
[3] Département de Géologie, Université Moulay Ismail, Morocco

Corresponding author: pcalvin@ubu.es

**Abstract:** The High Atlas is an ENE-WSW intracontinental chain generated during the Cenozoic as the result of the inversion of Mesozoic basins (Mattauer et al, 1977). The extensional stage is characterized by two rifting episodes during the Triassic and Lias-Dogger, both with an important associated igneous activity. Middle Jurassic alkali magmatism igneous rocks are characterized (Frizon de Lamotte et al, 2008 and references therein) by subvolcanic intrusive complexes and basaltic lava flows, being the product of significant crustal thinning linked to the second episode of rifting. These igneous complexes were emplaced along main fault zones, at pressures around 1.5 Kbar, between 145-160 Ma ago according to K-Ar and Ar-Ar ages (Hailwood and Mitchel, 1971; Armando, 1999). At present, gabbros crop out in the core of NE-SW anticlines, either as compact bodies or embedded in a mixture of Upper Triassic (claystones and evaporites) and igneous rocks.

The emplacement and deformational history of these gabbroic bodies are still a controversial matter (see discussion and references in Frizon de Lamotte, 2008). According to some authors, the intrusion of the gabbros is related to Jurassic transpression and cleavage development and they were exhumed during the Late Jurassic-Early Cretaceous. However, thermochronological data suggest that the exhumation of the gabbros is a relatively recent process and at least at 90-80 Ma they were still placed at depth. Furthermore, according to Saura et al. (2014), these bodies would have been placed at the core of early diapiric (generated during Early-Middle Jurassic) structures. Moreover, different deformation mechanisms, as diapirism or N-S shortening during the Cenozoic have been proposed to explain uplift and exhumation. The amount and timing of deformation and exhumation and the possible re-arrangement of gabbroic bodies in the core of diapirs is so far unknown. In this work we try to clarify some aspects of these controversies based on the application of paleomagnetism to these gabbroic bodies from the Central High Atlas. To achieve this

task, 38 paleomagnetic sites (8 individually oriented cores per site), from 5 different gabbroic bodies (Tassent, Tasraft, Tirrhist, Anergui and Anfgou outcrops) have been sampled. Systematic thermal and/or AF demagnetization of the NRM have been applied to samples from all cores. Most samples show a stable characteristic component with unblocking temperatures ranging between 520 and 580ºC and coercivity spectra between 15 and 50 mT. In some cases a very low coercivity phase with unblocking temperatures under 500ºC has been observed. Rock magnetic experiments, as IRM acquisition, hysteresis loops, thermomagnetic curves and thermal demagnetization of the IRM, as well as petrographic analysis, have been performed. The dominant magnetic phase is magnetite in PSD magnetic state in most outcrops with occasional contribution of Ti-Fe oxides, chromites and/or Fe sulfurs. The characteristic component shows good clustering at the site, metric-scale, but the site-means directions exhibit noticeable dispersion at the gabbroic body outcrop-scale. This directional dispersion observed in the remanent magnetizations of the studied gabbroic bodies has been interpreted from the structural point of view.

**Keywords:** Gabbro, Jurassic, High Atlas, paleomagnetism, rock magnetism.

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