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Magnetic fabric study of Mesozoic units from the Central High Atlas

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In this work the analysis of the anisotropy of magnetic susceptibility (AMS) has been applied to decipher the Mesozoic and Cenozoic evolution of the Central High Atlas.
The Atlas is the most important intraplate mountain range in North Africa, resulting from a complex evolution during the Mesozoic and the Cenozoic. Its evolution during the Mesozoic shows relevant extensional tectonics, magmatic activity and deformations associated with salt tectonic, factors that conditioned its subsequent alpine structure. The widespread compression during the Cenozoic led to the uplifting of the chain and its final structuring, especially at its northern and southern margins, where spectacular compressive structures can be seen. In the interior of the mountain range, the manifestations of this compressive stage were the folding (or re-tightening of structures) and the formation of tectonic foliation in the areas with higher thickness of sediments.
The Mesozoic series can reach several thousand meters thick, especially in the area selected for this study, which is located between the Demnate (west) and Tounfite (east) transects. The structure of the study area is characterized by dominant folds of NE-SW direction, which interfere with folds of smaller scale (in some cases also pluri-kilometrics) of oblique or perpendicular orientation. The synclines are generally gentle, with wide areas of weak or horizontal dips, while the anticlines are narrow and tight, with steep dips. The anticlinal cores are occupied by Triassic lutitic and evaporitic facies and in some cases by igneous rocks.
A total of 250 new sites (2872 standard specimens) scattered throughout the Triassic, Jurassic and Lower Cretaceous outcrops in the Central High Altas, were analyzed by means of AMS. Samples were measured in a KLY3-S Kappabridge (AGICO) susceptometer at the Zaragoza University. Magnetic carriers were determined by carrying out temperature-dependent susceptibility curves (from 40 to 700ºC) combining the susceptibility bridge with a CS-3 furnace.
Bulk magnetic susceptibility ranges between 0 and 1910x10-6 SI, although 95% of sites have values lower than 600x10-6 SI. Thermomagnetic curves indicate the presence of paramagnetic behavior in most runs and the presence of magnetite as main ferromagnetic contribution.
Magnetic ellipsoids can be divided into four main types depending on the orientation of the main axes: 1) sub-horizontal NW-SE kmax and kmin normal to bedding (25% of the sites); 2) sub-horizontal NE-SW kmax and kmin normal to bedding (21% of the sites); 3) sub-horizontal NW-SE kmax and kmin within bedding (20% of the sites); 4) sub-horizontal NE-SW kmax and kmin within bedding (14% of the sites); additionally sub-horizontal N-S kmax and E-W kmax, and vertical kmax are also observed (in 11%, 2% and 7% of the sites respectively). Type 1 fabric is mainly associated with gentle synclines and can be related to Mesozoic extensional tectonic, while type 2 and 4 fabrics can be interpreted as modified by compressional tectonic. On the other hand, fabrics with vertical magnetic lineation are located near the core of narrow and tight anticlines and can be interpreted as related with salt tectonics and re-tightening of structures.