Geophysical Research Abstracts
Vol. 21, EGU2019-17267, 2019
EGU General Assembly 2019
© Author(s) 2019. CC Attribution 4.0 license.

Inverse paramagnetic fabrics recorded in the active Alhama de Murcia fault: an integrated study of structural analysis, AMS, LT-AMS, AARM and pAIRM

Marcos Marcén (1), Antonio M. Casas-Sainz (1), Teresa Román-Berdiel (1), Pablo Calvín (2), Juan José Villalaín (2), and Andrés Gil-Imaz (1)

(1) Departamento de Ciencias de la Tierra, Geotransfer-IUCA, Universidad de Zaragoza, 50009 Zaragoza, Spain, (2) Laboratorio de Paleomagnetismo, Departamento de Física, Universidad de Burgos, 09006 Burgos, Spain

Fault zones constitute areas of high permeability where fluids and minerals interactions are frequent, involving the neoformation and alteration of protolith-inherited, ferromagnetic and paramagnetic minerals. This fact entails that fault zones are in most cases characterized by a heterogeneous mineralogy which hinders their study through magnetic fabrics or paleomagnetism studies. Furthermore, previous studies suggest that the orientation of the magnetic lineation (kmax) is strongly conditioned by the neoformation of ferromagnetic minerals, since they tend to develop stretching-parallel magnetic lineations. We present in this work the preliminary data obtained in the Alhama de Murcia fault zone (SE Spain) in a detailed study of magnetic mineralogy and magnetic sub-fabrics, trying to isolate the contributions of the different magnetic mineralogies to the total RT-AMS.
The Alhama de Murcia fault is one of the main active structures that have controlled the building of the Betic system since Neogene until present times as a consequence of the plate convergence between Eurasian and African plates. The studied fault rocks are developed in Devonian, low-grade metamorphic schists from the Betic basement (Alpujárride Unit) and are characterized by the development of brittle shear and foliations planes (SC structures), which are compatible with a sinistral, strike-slip movement of the fault. Attending to the RT-AMS results, two types of magnetic fabrics can be separated: i) oblate fabrics ($T>0$) characterized by kmin perpendicular to foliation planes and kmax parallel to stretching lineation (normal fabrics) and ii) prolate fabrics ($T<0$), with kmax perpendicular to foliation planes and kmin parallel to stretching lineation (inverse fabrics). Mineralogical and rock magnetism analysis (k-T curves, IRM thermal demagnetization) lead us to correlate these types to different magnetic mineralogy of the samples. Normal fabrics, with kmax parallel to stretching lineation, are carried by ferromagnetic minerals, since the same orientation of the magnetic axes are observed in AARM and pAIRM measurements (fields of 100, 400 and 2000mT were applied, trying to cover all coercivity spectra observed in IRM analysis). Inverse fabrics are related to paramagnetic minerals since LT-AMS-measurements show this type of magnetic fabric and higher k-LT/k-RT ratios are observed in samples where inverse fabrics dominate at RT-AMS. This fact, together with the similar magnetization acquired in AARM and pAIRM measurements in both types of fabrics, suggest that the relative contribution of paramagnetic minerals is the critical factor that conditions the existence or absence of inverse fabrics.
In general, inverse fabrics are related to the presence of single-domain ferromagnetic grains. Previous studies in Fe-bearing carbonates (paramagnetic minerals) indicates that depending on the Fe content, all these minerals are able to develop higher magnetizations along their short crystallographic axis. SEM observations indicate the presence of neoformed, Fe-rich ankerite ($Ca(Mg,Fe)(CO_3)2$) in our samples. Indeed, thermal treatment of the samples for classic paleomagnetic studies induces the transformation of this mineral into calcite and magnetite, with a consequent $\approx$5000% increase of the magnetic susceptibility with respect to the not-heated sample. RT-AMS measurement of the heated samples confirms that the destruction of ankerite grains also leads to the disappearence of inverse fabrics.