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Magnetic anisotropy vs. palaeostress analysis of Lower Miocene lacustrine sediments from the Ebro basin (Spain): preliminary results

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The study of the Anisotropy of Magnetic Susceptibility (AMS) in fold-and-thrust belts and foreland basins has become widespread because it is often the only available tool to infer the deformation suffered by mudrocks that seldom show measurable deformation markers. The rationale of the application of AMS data in structural studies is that magnetic fabrics mirror the preferred orientation of phyllosilicate grains. In the last few years, a growing body of evidence derived from AMS studies suggests that magnetic fabrics are blocked at the earlier stages of diagenesis, and it has been proposed that a close relationship with palaeostresses exists. For deformation to have a direct correlation with stress, it must be recording an infinitesimal, quasi-instantaneous strain, which can be achieved if it generated and blocked quickly, before the deformation further developed.

Here we present a comparison between preliminary magnetic anisotropy data (AMS), obtained from lacustrine grey-bluish mudrocks of the Tudela Formation (lower Miocene), and previously published palaeostress results obtained from interbedded limestones. The Tudela Formation crops out horizontal at the central sector of the western Ebro basin, and its lacustrine origin reduces the possibility of preferential orientations of minerals at deposition, that is, any oriented fabric should record and early episode of infinitesimal strain.

Palaeostress results obtained from the abundant strike slip faults affecting limestones reveal $\sigma_1$axes with a NNE-SSW direction, perpendicular to the neighbour Pyrenean and Iberian thrust fronts, and horizontal ESE-WNW trending σ_3. Similarly, the anal-

ysis of joint sets and normal faults yields a σ_3 axis oriented ESE-WNW. AMS results obtained at the same sites in mudrocks indicate a clear tectonic overprint, in such a way that k_{max} axes cluster around a ESE-WNW direction perpendicular to $\sigma_1$axes.

The correspondence between AMS and palaeostress results indicates that magnetic fabric analysis might be a useful technique for reconstruction of the earliest stress fields in mudrocks. Moreover, as ASM could be a more sensitive marker than fracture patterns, it has the potential ability to record subtle stress heterogeneities caused by fractures or lithological layering.