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Anisotropy of Magnetic Susceptibility: a petrofrabric tool for understanding mechanisms of fold and thrust belt evolution. Application in Malargüe FTB, Argentina

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In fold and thrust belts (FTB), sedimentary beds are folded and faulted but rocks do not always show evidence of strong internal deformation. Nevertheless, several studies have demonstrated that a weak internal deformation (layer parallel shortening) can be recorded at the matrix scale before any macroscopic deformation. The Anisotropy of Magnetic susceptibility (AMS) provides information about the preferred orientation of billions of magnetic minerals. It enables the definition of a magnetic fabric, which may be visualized as an ellipsoid with principal axes K1 $\geq$ K2 $\geq$ K3. Basic elements of a magnetic fabric are the magnetic foliation (K1-K2 plane) and the magnetic lineation (K1 axe), when they are statistically defined. Both are related to strain-controlled petrofrabric.

The Neuquén Basin is a wide intracratonic sag basin with complex and polyphased/diachronic evolution. The Pacific subduction and south Atlantic opening were the mechanisms controlling the large scale geodynamic framework. By late Triassic times, continental scale extension initiated fault-related narrow rift depocenters which later evolved toward a sag basin from middle Jurassic to upper Cretaceous. At that time, the basin started to record the compressive stress regime from the Pacific subduction. Three pulses of compressive deformation (Cretaceous, Paleogene and Miocene) are recorded in this retro-arc foreland setting.

Approximately 300 samples have been collected from 30 sites in terrigenous rocks located along three cross sections from foothills to uplifted foreland area in Malargüe FTB. We mainly sample Kimmeridgian red beds of the Tordillo formation, Tithonian shales from the Vaca Muerta Fm, and late cretaceous red beds of the Neuquén Group. AMS fabrics are used as a proxy to measure accumulated microscopic finite strain and compares it with mesoscale (fractures) and macroscale structures (faults, folds…). This multi-scaled approach helps in defining a kinematic scenario for Malargüe FTB evolution by classifying magnetic fabrics related either to (1) sedimentary processes or (2) pre-folding layer parallel shortening (LPS) or (3) syn-folding kinematics depending on folding mode. Propagation of deformation in this case is neither uniform nor gradual. Therefore Malargüe FTB cannot be defined as a classical critical wedge; On the contrary extensional inheritance exerts a strong influence in localization of compressive deformation (LPS).