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Magnetic fabric results in weakly deformed deposits from extensional and compressional domains of the Northern Apennines (Italy)

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Since 1960s the anisotropy of magnetic susceptibility (AMS) analysis has been used to reconstruct the deformation history of rocks, and many studies have been published regarding the relationships between magnetic fabric and tectonics. Nevertheless, an active scientific debate still exists on the tectonic or sedimentary origin of the magnetic fabric observed in sedimentary rocks in which visible evidence of deformation is lacking.
In this work, we present results from AMS analyses carried out on weakly deformed fine-grained sediments from the Northern Apennines (Italy). We analyzed pre-, syn- and post- orogenic sequences, which differ in age, composition, depositional environment, degrees of deformation and tectonic regimes. The AMS fabric of these weakly deformed sediments is characterized by a magnetic foliation sub-parallel to the bedding plane, and a magnetic lineation well-defined in this plane. The sediments are characterized by strongly oblate magnetic susceptibility ellipsoids suggesting that magnetic fabric results from both compaction process and tectonic load during diagenesis and orogenic events. The orientation of the magnetic lineation with respect to the main tectonic elements depends on the regional tectonic context, and in particular it varies between extensional and compressional tectonic regimes. In the pre- and syn- orogenic deposits of the more internal arc of the Apennine chain, the lineation is mostly NNW-SSE, parallel to the main compressional structures (folds and thrusts), suggesting a tectonic origin of the magnetic lineation with an acquisition related to the Apennines compressional phases. Instead, in the post-orogenic deposits of the extensional basins developed along the Tuscan Tyrrhenian Margin, magnetic lineation is oriented ENE-WSW, almost perpendicular to the main extensional faults which represent the main deformation elements of the area. Our results indicate a distinctive linkage between the magnetic fabric and the local tectonic settings, confirming that AMS represents a valuable tool to investigate the tectonic history of weakly deformed sedimentary rocks.