26th IUGG General Assembly, A10 Paleomagnetism and Magnetic Fabrics Applied to Tectonic and Volcanic Processes (Div. I). Abstract: IUGG-1601

Towards an integrated reconstruction of the deformation field from simultaneous magnetic and mesotectonic data

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Observable fractures in rocks are widely used to reconstruct the stress field in the geological past and even to separate deformation phases. Deformation that induces faulting of a rock very often imprints its original magnetic fabrics. This process, under certain circumstances, aligns the magnetic lineation with the direction of tectonic extension. Both magnetic and mesotectonic methods involve statistical evaluation of their own and are often used independently. In case of joint interpretation of the results, the comparison is always a qualitative one. This presentation investigates the possibilities of simultaneous statistical evaluation of magnetic fabric and mesotectonic measurements.

First it is pointed out that the well-known behaviour of deterministic tensors, namely that the multiplicity of the eigenvalues unambiguously refers to the spatial distribution of the eigenvectors, does not hold for matrices with random variable elements. The published methods focus dominantly on the eigenvalues, therefore are not satisfactory in case of tensors close to rotationally anisotropic, like those characteristic of weakly deformed sediments. We present a new statistical approach applicable for such cases.
Concerning brittle deformation, the widely discussed ambiguity of the Wallace-Bott hypothesis underlying most of the stress inversion methods of the literature implies a significant uncertainty. Nevertheless, the statistical method mentioned above can be readily applied for evaluating e.g. orientation data of faults and striae.

The applicability of the integrated framework of simultaneous data evaluation is documented by examples from the Transdanubian Range and Slovenia.

This work was financially supported by Hungarian Scientific Research Fund (OTKA) project no. K105245.