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Constraints on the mechanics of folding from paleomagnetic data

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We analyzed published paleomagnetic data sets from fold belts upon actual fold geometry and the way how layers become tilted and rotated during deformation by folding. The analysis bases on the combination of remanence vectors and bedding poles to bipod-like pairs of vectors. These vector pairs have new geometrical properties that allow to study the path of tilting and rotation. From our analysis of more than 100 data sets, several general observations turn out: (1) Bedding strikes are in most cases varying significantly around a mean strike, showing a standard deviation of about 30° on average. A simple concentric fold geometry as often presupposed by paleomagnetists is rather the exception than the rule. (2) The strike variations originate initially with folding, being a general feature of heterogeneity in the early stage of deformation. (3) Until a layer dip of about 30°-50°, the layers are being tilted around (sub)horizontal axes parallel to respective bedding strike. (4) When folding proceeds, layers with the dip azimuth parallel to the shortening direction (‘compatible layers’) continue in the same way. ‘Incompatible’ layers with the dip azimuth at an angle to the overall shortening direction, in contrast, become accomodated by rotation around (sub)vertical axes. Tilting and vertical-axis rotation perform simultaneously; the bedding poles follow curved paths in the stereoplot. This process of accomodation is referred to as ‘layer parallelisation‘. It can be seen in present and ancient fold belts.