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Intersections of remanence small circles: new tools for palaeomagnetism

M. Waldhör, E. Appel

Institute for Geoscience, Univ. of Tuebingen (martin.waldhoer@uni-tuebingen.de, +49-7071-707794)

Intersections of remanence small circles are increasingly used in palaeomagnetism to determine the palaeofield direction from synfolding remanences. The approach ('SCI-method') presupposes that remanence small circles from sites tilted to different directions intersect in a common point, which is assumed to represent the palaeofield direction. The SCI-method is not restricted to synfolding remanences. It can be applied also to derive the palaeofield direction from prefolding remanences, in addition to tilt correction and as a cross-check for fold tests. However, the SCI-method has specific requirements and does not work in all cases. The suitability of data sets and reliability of palaeofield estimates have to be assessed carefully and always against the background of local geology. We examine the occurrence and distribution of small circle intersections as a tool of judgement: First, a data set is most suitable and a palaeofield estimate by SCI most reliable, when most of the theoretically possible intersections are realised and, in addition, clearly grouping in a narrow region. Second, the small circles that greatly determine the result of SCI, are identified by the highest number of intersections they have with the others. These criteria allow a systematic investigation of SCI-estimates upon stability and dependencies. Small circle intersections can also be an indicator of irregular, unexpected tectonic settings. When the intersections disperse strongly although significant bedding strike differences are given, relative rotations or other unexpected displacements are likely to have occurred. If so, the SCI-estimate will be invalid and probably biassed, however, also Fisher mean calculation and most fold tests will be affected. In this case, the small circle intersections can help to separate the data into subsets valid for Fisher statistics and SCI-methods. The other possibility is to use tentative reconstructions to infer the true sequence of tilts and rotations and correct the data adequately.