



Interpretation of remagnetization directions by Small Circle methods. Application to various tectonic problems

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Secondary magnetizations have been used to constraint geological models in spite of the difficulties of dating the remanence age and the uncertainty in applying the valid tectonic correction, specially if the remagnetization is syntectonic. The fold test is the main tool used traditionally to identify and interpret remagnetization. In particular, the incremental fold test has been applied to attempt calculating the appropriate tectonic correction in synfolding remanences. However the fold test assumes symmetrical deformation giving erroneous solutions when dealing with asymmetrical folding. This strongly limits the use of the fold test because asymmetric tectonic evolution is very common in different geological processes. Therefore, it is necessary to use alternative techniques for analyzing remagnetization directions. In this sense, the use of small circles (SC) represents a very interesting option because it allows considering asymmetric deformations and degrees of freedom which fold test restricts.

A SC is defined by a complete rotation of the in situ site mean paleomagnetic direction about the strike of bedding (i.e. the apical angle of its cone is the angle between the paleomagnetic vector and the strike of beds). In this presentation we analyze the use of SC for analysis of remagnetization directions in two phases: a) determination of the magnetic field direction at the remagnetization acquisition time by calculating the SC intersection (SCI) by methods described by Shipunov (1997) or Waldhör and Appel (2006). This obtained direction can be used to date the remagnetization by comparison with the APWP, but also as reference direction for restoration of the rotated remagnetization directions. And b) calculation of the bedding plane at the moment of the acquisition of the remagnetization (paleodip) by restoring the in situ remagnetization directions using each SC as described Villalaín et al. (2003), Henry et al. (2004) and Villalaín et al. (2015).

In this work we discuss about the methodological problems observed when using SC analysis, such as the effect of the degree of coaxiality of different tectonic events on the uncertainty of the SCI solution and tectonic corrections, the presence of vertical axis rotation, etc.

In addition we analyze different examples of application of SC techniques to solve different tectonic problems in areas affected by widespread remagnetizations, such as palinspastic reconstructions of inverted sedimentary basins, distinction of overlapped deformation events, identification of intra-Mesozoic stages in alpine chains, etc.