



The reliability of paleomagnetic directions

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Van der Voo (1990) proposed seven criteria to reliably determine a paleomagnetic pole. One of his criteria deals with the number of samples and the adequate statistical precision required to obtain a reliable mean direction, i.e. to average out secular variation of the geomagnetic field. He advised to average at least 24 samples with a precision parameter, k of at least 10.0 and a maximum α_{95} of 16 degrees. Van der Voo (1990) mentioned that this is a preference and that previous studies used different criteria. In paleomagnetic analysis Fisher statistics are applied on the obtained directions, however, it was recently stressed by Tauxe and Kent (2004) that observed geomagnetic field behaviour fits better with the Virtual Geomagnetic Poles (VGPs) to be Fisherian rather than distributions of measured directions, which are consequently elongated in a north-south direction, especially at low and mid latitudes.

We therefore argue that criteria based on the use of Fisher statistics on the VGPs are preferred and that it is necessary to look at the deviations from the mean in inclination and declination separately. We used both the statistical model for the geomagnetic field of the last 5 My from Tauxe and Kent (2004) and a set of purely Fisherian VGPs to derive the minimum number of samples required to sufficiently sample the ancient geomagnetic field, including the ranges of values expected for α_{95} and k .

We propose new criteria to determine the number of lavas or sedimentary samples needed for both a reliable inclination and declination. However, for sediments these criteria determine only a reliable declination due to a flattening of the inclination. Additionally, it is advisable to apply a correction for the inclination flattening using the elongation/inclination method introduced by Tauxe and Kent (2004), to obtain a reliable inclination.

Preliminary results indicate that it is desirable to have at least a total set of 50 direc-

tions to average out secular variation within 5 degrees of the expected mean. The use of the elongation/inclination method requires at least ~ 200 samples.

R.van der Voo, 1990. The reliability of paleomagnetic data. *Tectonophysics*, 184: 1-9.

L. Tauxe, D.V. Kent, 2004. A simplified statistical model for the geomagnetic field and the detection of shallow bias in paleomagnetic inclinations: was the ancient magnetic field dipolar? *Timescales of the Paleomagnetic Field. Geophys. Monogr. Am. Geophys. Union*, 145: 101– 115.