Paleomagnetic mean directions in paleolatitude: true mean and apparent mean

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Here we qulitatively and quantitatively indicates the effect of the non-dipole components of the mean geomagnetic field (TAF) and the paleosecular variation (PSV) on the averaged paleomagnetic direction, and report the problems in case of the application of the paleomagnetic direction data to the tectonics and the way of the modification of them.

When we discuss tectonics with use of paleodirection data, each direction datum and/or the virtual geomagnetic pole (VGP) is averaged on a unit sphere. Paleolatitude and relative posision of the tectonic segment or the plate is guessed with assumption of the geocentric axial dipole (GAD) field hypothesis.

However, the temporal mean of the geomagnetic field contains not only the GAD but also the non GAD which is mainly dominated by the geocentric axial quadrupole (GAQ) component.

The combined field of GAD and GAQ components makes the observable inclination smaller than it only due to the GAD field. The inclination anomaly, the GAD-inclination subtracted from the observed inclination, is negative anywhere and its latitudinal dependence is symmetrically shaped with respect to the equator.

The apparent artifact due to averaging of the direction data is positive in the south hemisphere and negative in the north hemisphere. The shape of the latitudinal dependence is axiantisymmnetric with respect to the equator.

The combination of above two factors can be actually observed in the inclination anomaly. For instance in the site at latitude 20 degrees north, the former is about -3 to -4 degrees and the latter effect is between -1.5 to 2 degrees seen in the inclination anomaly calculated by Hatakeyama and Kono (2002). These are not able to be neglected in case that we treat detail tectonic problems.