Geomagnetic Field at the Mesoproterozoic - Geocentric Axial Dipole?

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New Mesoproterozoic paleomagnetic data have been produced for Baltica from Subjotnian mafic dyke swarms in Finland (e.g. Salminen et al., 2014; 2015). The data are of high quality, with well-defined U-Pb ages, showing two polarities of remanence. These data all show a fairly large asymmetry: i.e. the mean directions are not antiparallel at 95% confidence level and do not pass the reversal test (McFadden & McElhinny 1990). The following explanations for the asymmetry are discussed: (1) contamination of the dipole field by a permanent non-dipole field (e.g. Veikkolainen et al., 2014a,b); (2) an unremoved secondary component; (3) age difference between dykes showing reversed (R) and normal (N) polarity coupled with continental drift (Swanson-Hysell et al., 2014); (4) relative crustal tilting between R- and N-polarity "dominated" blocks (Halls & Shaw 1988).

(1) Inclination and reversal asymmetry analyses of global Precambrian data indicate that the Geocentric Axial Model of the geomagnetic field is valid during the Precambrian. (2) Secondary component vector addition to a probable, antiparallel primary component give rise to N and R components similar to the observed N and R components. Furthermore, the N-polarity data have a wider dispersion of inclinations than R-polarity. Additional support for component mixing comes from the secondary component distribution, which is streaked in part toward the N-polarity direction. (3) A small but significant age difference between N and R magnetized dykes could explain the asymmetry, but the actual age span for the Subjotnian dykes for Baltica awaits further precise datings. (4) Majority of the dips of the R- and N-polarity dykes are vertical to subvertical and and so do not support the different tilting of the blocks.

References:

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