

Observational evidence for a geodynamo driven by thermal energy in the outermost core and by precession deeper in the outer core.

VGP (Virtual Geomagnetic Pole) paths during reversals are preferentially located in roughly north south circum-Pacific arcs, above where the lower mantle is coolest. This indicates that the movement of magnetic flux concentrations in the outermost core responds to thermal constraints during the reversal. Hence thermal energy is involved in driving the geodynamo. The preponderance of the occurrence of reversals when the obliquity is lower than the average within the last 5 Ma, and their preferential onset during the decreasing half of the obliquity cycle provide evidence for a role of precession in driving the dynamo. The geodynamo therefore appears to be driven by a combination of thermal and precession energy. A reversal with its decay of the dipole intensity by almost an order of magnitude, the polarity switch, and regrowth of the new axial dipole involves an intermediate equatorial field source, whose polarity also switches with the axial dipole and the whole reversal process takes roughly one obliquity cycle of 41,000 years.