

Polar wandering

In view of recent observations of remanent magnetism in suitable geological horizons the possibility during earth history of considerable "polar wandering" must now be under serious consideration; the exact meaning of the phrase seems however to deserve some preliminary examination.

The pole of figure we may define as the North (or South) end of that axis about which the angular inertia of the ^{solid earth, allowing} crust, ~~excluding~~ ^{the adjacent atmosphere & rotation about this point} the oceans and atmosphere is, at any time, greatest. The pole of rotation, determined by astronomical observations of great accuracy, moves somewhat irregularly about the pole of figure with a period of about 400 ^{or 400} days, at a distance commonly of about 10 metres. Between these and only about 2 cm from the pole of rotation is the pole of angular momentum. Apart from external forces, and perhaps interactions with the liquid core, the pole of angular momentum must lie under a point fixed in the heavens, but by reason of the ^{diurnal} ~~diurnal~~ ^{rotation} ~~rotation~~ ^{moves} over the ground by a few inches daily, carrying with it the pole of rotation, in accordance with Euler's equations in a circle about the pole of figure.

The figure of the ocean surface must adjust itself, with inappreciable dissipation of energy to the instantaneous rotation so bringing the dynamical pole some way from the pole of figure towards the pole of rotation. The proportion of this shift would be expected to be rather less than the ratio of the density of

the ocean to that of the surface rocks, perhaps 30%, so that the time of ⁿrotation would be lengthened by this cause, with which other elastic deformations may be included, from ^{about} 360 days for a rigid earth to the period observed. The accompanying stresses in the earth's crust would be less than those commonly due to variations of barometric pressure, but would be recurrent in the same directions every 14 months.

Fault movements in the crust must each somewhat disturb the pole of figure. If these were statistically unrelated to the phase of ⁿrotation the amplitude would tend to *increase* indefinitely. Consequently, if the present proximity of the pole of rotation to the pole of figure is not a transitory and fortuitous condition, the changes must in the statistical long run be such as to make the pole of figure approach the pole of rotation more often than not, or in other words the small stresses caused by obliquity of rotation must be affective in remoulding the geoid, and be capable of moving the pole of figure progressively in the same direction at some of the recurrences of the same phase.

External *torques* exerted by heavenly bodies, or by the liquid core, would seem to cause only a *precession* of the pole of angular momentum in the heavens without affecting the position of the pole of figure on the earth's surface.

We would suggest that very accurate plotting of the movements of the pole of rotation would provide a foundation for rough estimates of the velocity of systematic *movement* measurement of which the

pole of figure, in the present state of the earth, is capable.