Model suggests Earth is undergoing true polar wander

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At various points throughout Earth's history, the planet's solid exterior has drifted about in relation to the planetary rotation axis. This solid body drift, which is known as "true polar wander," results in a wholesale shift in the orientation of Earth's landmasses and is different from the motion of individual tectonic plates ("tectonic drift") or of the magnetic pole ("apparent polar wander").

Sorting out when, in which direction, and at what rate the Earth's solid exterior has rotated in this way depends on having a stable frame of reference to which observations of relative motion can be compared. To develop such a frame, researchers rely on hot spots, regions of recurrent volcanism that are known to produce long, largely linear island chains - such as the Hawaiian islands - as an overlying tectonic plate passes overhead. Hot spots are fed by magma plumes from the deep mantle and hence tend to be long-lived and relatively stable. Hot spots have long been used to understand the motion of tectonic plates.

Traditionally, scientists have treated hot spots as completely static features. But by allowing hot spots' positions to slowly drift, Doubrovine et al. produced a model of a stable reference frame that better matched observations of hot spot tracks - the path drawn by each hot spot's island chain. Based on their new reference frame, which they consider accurate for the past 120 million years, the authors identify four possible instances of true polar wander, including two in which the solid Earth traveled back and forth by nearly 9 degrees from 90 to 40 million years ago. Further, they suggest that for the past 40 million years the Earth's solid outer layers have been slowly rotating at a rate of 0.2 degrees every million years.

More information: Absolute plate motions in a reference frame defined by moving hot spots in the Pacific, Atlantic and Indian oceans, *Journal of Geophysical Research - Solid Earth*, doi:10.1029/2011JB009072 , 2012

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