SPEEDING NEOPROTEROZOIC-PALEOZOIC CONTINENTS: PLATE TECTONICS OR TRUE POLAR WANDER?

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Paleomagnetic data from many of the Neoproterozoic to early Paleozoic continents indicate rapid shifts in latitude or near-axis rotations. Whereas this has been attributed to a slightly hotter Earth at ~500 Ma, or an enhancement of plate velocities by continental roots and deep mantle driving forces, an exciting alternative is that of true polar wander (TPW), in which the entire solid Earth shifts uniformly under its spin axis. Hypotheses of rapid TPW implicate strict tests of the paleomagnetic database--all of the continental elements need to show the nearly same amount of apparent polar wander over the time interval in question. Although new data from Laurentia force modification of the original Cambrian inertial-interchange TPW hypothesis of Kirschvink et al. (1997), there is the possibility that more than one episode of rapid TPW occurred in late Neoproterozoic-Cambrian time, with a common euler axis of global rotation. Several lines of evidence support this model: (1) coaxial TPW oscillations are a predictable consequence of long-lived supercontinents such as early Neoproterozoic Rodinia, which may induce a prolate geoid that is rotationally unstable; (2) all of the paleomagnetically well constrained late Neoproterozoic cratons show great-circle distributions of paleopoles, consistent with oscillatory motion; (3) in at least a few well documented instances, the oscillations are occurring at rates that would be surprising if due to plate tectonics; and (4) the TPW interpretation for these rotations produces a global paleogeography that is consistent with that proposed on geological grounds.