EGU21-13574
https://doi.org/10.5194/egusphere-egu21-13574
EGU General Assembly 2021


# Relative Timing of the Eocene Global Reorganization of Plate Motions: New Results for Pacific Plate Hotspot Tracks

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To improve modeling of deep-earth dynamics it is important to understand changes in the arrangements of plate boundaries, especially trenches accommodating subduction, and major changes in tectonic plate motion. Here we focus on the sequence of key surface events in Eocene time that likely coincide with changes in deep-earth dynamics. In particular, we develop methods of analysis of seamount locations and age dates using a small number of adjustable parameters (10 per chain) on the Pacific plate with a focus on the timing of the Hawaiian-Emperor bend relative to the timing of other major Eocene tectonic changes.

We find that motion between hotspots differs insignificantly from zero with rates of 2±4 mm/a (±2σ) for 0-48 Ma and 26±34 mm/a (±2σ) for 48-80 Ma. Relative to a mean Pacific hotspot reference frame, nominal rates of motion of the Hawaii, Louisville, and Rurutu hotspots are ~5 mm/a and differ insignificantly from zero. We conclude that plumes underlying these Pacific hotspots are more stable in a convecting mantle than previously inferred.

We estimate the locations and ages (with uncertainties) of bends in Pacific hotspot chains using a novel inversion method. The location of the ~60° change in trend at the Hawaiian-Emperor bend is well constrained within ~50-80 km (=2σ), but the location of the bends in the Louisville and Rurutu hotspots are more uncertain. If the uncertainty in the location of the bend in the Louisville chain is included, we find no significant difference in age between the bends of different Pacific hotspot chains. The best-fitting assumed-coeval age for the bends is 47.4±1.0 Ma (±2σ), which is indistinguishable from the age of the C21o geomagnetic reversal. The age of the bend is younger than the initiation of subduction in the Western Pacific, but approximately coeval with changes in Pacific and circum-Pacific relative plate motion. Changes to the tectonic system near the age of the bend are not limited to the Pacific basin. The smooth-rough transition flanking the Carlsberg Ridge records a threshold in the decreasing spreading rate between India and Africa, thought to record the onset of the collision of India with Eurasia, and is constrained to be between C21y and C20o (46 Ma and 43 Ma) in age. Nearly simultaneously, South America and Australia began to diverge more rapidly from Antarctica. The Eocene bend in Pacific hotspot chains may be the most evident feature recording a global re-organization of plate motions and mantle circulation possibly caused by the earlier collision of India and Eurasia or initiation of western Pacific subduction.