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New evidence for the Hawaiian hotspot plume motion since the Eocene

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Abstract

A thick mound of fossiliferous sediments, reflecting high biogenic productivity at the Equator can be used to determine latitudinal motion of the Pacific lithospheric plate. Plate motion estimates based on the latitudinal movement of Equatorial facies are independent of paleomagnetic data and hotspot tracks and thus permit further testing of kinematic models. We have determined the northward motion of the Pacific Plate for the last 53 Myr based on the position of the paleoequator as shown by Equatorial sediment facies. Between 26 and 69 DSDP and ODP Sites sample the past 53 Myr in the tropical Pacific. Based on the mapped patterns of accumulation rates in these sites, we were able not only to determine the position of the paleoequator but also to estimate the Equatorial great circle and hence the relative position of the spin axis since the early Eocene. The northward motion of the Pacific Plate inferred from the change in latitude of dated Hawaiian Chain seamounts relative to the Hawaiian hotspot is consistently higher than that deduced from the analyses of Equatorial sediment facies. Such a difference results from a latitudinal shift of the Hawaiian hotspot during the last 53 Myr. All together, our observations and recent paleomagnetic results from the Detroit, Nintoku and Koko seamounts [J.A. Tarduno, R.A. Duncan, D.W. Scholl, R.D. Cottrell, B., Steinberger, T. Thordarson, B.C. Kerr, C.R. Neal, F.A. Frey, M. Torii, M., C. Carvallo. The Emperor Seamounts: Southward motion of the Hawaiian hotspot plume in Earth's mantle. Science 301 (2003) 1064–1069.] [1] are consistent with a progressive southward motion of the Hawaiian mantle plume since the Late Cretaceous. Our results suggest that the Hawaiian hotspot moved at ~32 mm/yr to the SE during the past 43 million years and that the Pacific Plate moved ~12° northward since 53 Ma at an average rate of 25 mm/yr.

Keywords: Pacific Plate; mantle plume; Hawaiian–Emperor chain; Paleogene

1. Introduction

Determining pole positions of oceanic plates is hampered by the lack of exposed lithosphere. Oceanic plate motion is thus based on three different types of data: (a) remote sensing data including skewness of

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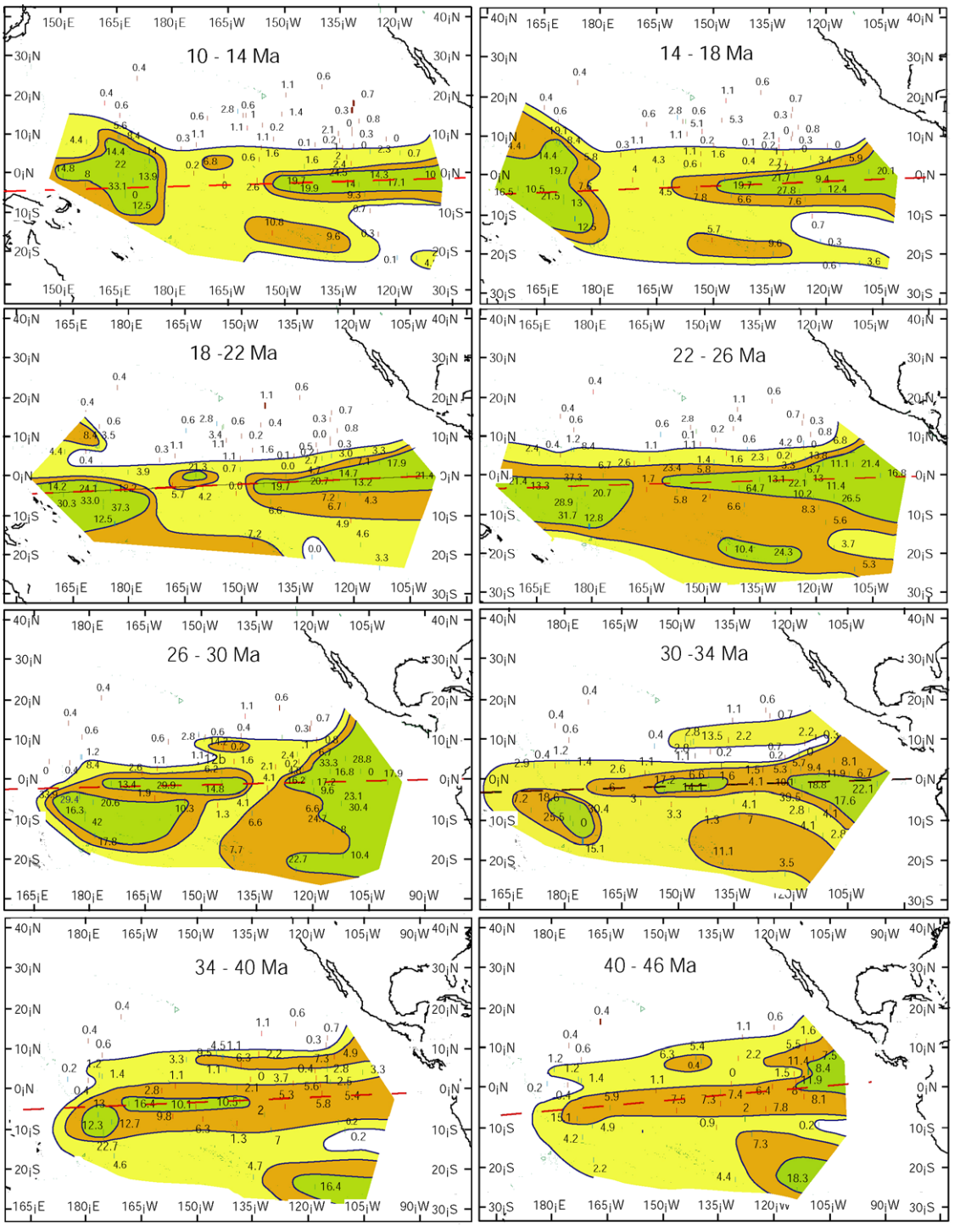
10 - 14 Ma
14 - 18 Ma
18 -22 Ma
22 - 26 Ma
26 - 30 Ma
30 -34 Ma
34 - 40 Ma
40 - 46 Ma