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Pacific basin inter-hotspot motion

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Historically, hotspots have been used to define a fixed reference frame for plate motions: however, since hotspots are rooted within a dynamically convecting mantle, it is hard to believe that the fixity is absolute and insted slow motion between hotspots are expected to be occuring. Thus 'how slow' is the central issue that needs to be addressed. Harada and Hamano (2000) and Harada and Wessel (2003, in prep.) showed that the mean speed since 70Ma for inter-hotspot motion within the Pacific plate is less than 4 or 5 mm per year. Recently however, Steinberger (2002) suggested a numerical model for westward motion of the Easter hotspot at several cm per year relative to the Hawaii and Louisville hotspots.

To test his hypothesis we dredged more than 70 sites along the Nazca Ridge and Easter Seamount Chain during the Drift expedition, Leg 6, of the R/V Revelle and dated more than 20 samples using the Ar/Ar method to examine the motion of the Easter hotspot relative to the Pacific hotspots. To estimate the positions and ages of the Easter hotspot track on the Nazca plate, we needed a good model of the absolute motion of the Nazca plate (Nazca APM) and present location of the Easter hotspot. For the modeling of the Nazca APM, we combined several existing models of Pacific APM with Pacific-Nazca relative motions (Pac-Naz RPM) determined from magnetic anomalies, and investigated the differences of these Nazca APM models. To determine the present location of the Easter hotspot, we applied the hotspotting technique (Wessel and Kroenke, 1997) using the Nazca APM models, and then examined the differences in the optimal CVA locations. Because the hotspotting technique can predict the present position of a hotspot without using any age data, we could test the modeled ages of the theoretical hotspot track by comparing them with observed ages of the hotspot track.

The present position of the Easter hotspot is found to be near Salas y Gomez Island, not Easter Island. Although there are some dispersion owing to the various Nazca APM models used, the result shows that the position and ages of the modeled hotspot track well explain the observed geometry and ages, and there appears to be no systematic difference with time or distance from the present position. The suggested speed for inter-hotspot motion between the Easter and the Pacific hotspots would therefore be less than 10 mm per year.