EGU 2005 MEETING - GD05/T31 Session

Mantle Plumes, intraplate magmatism, and hotspot-ridge interaction: Geodynamical, Geophysical and Geochemical Aspects (GD05 - T31)

This session will address geophysical observations and models related with the occurrence of oceanic intraplate volcanism (i.e., hotspot magmatism) and with the interaction of hotspots with nearby ridges.

Hotspots and mid-ocean ridges are two major manifestations of terrestrial magmatism. While mid-ocean ridge magmatism is broadly accepted to be the result of passive mantle upwelling and subsequent decompression melting induced by plate separation, the origin of hotspot magmatism is less well established. The standard model is the thermal plume model, which asserts that hotspot magmatism is associated to the presence of hot mantle plumes arising from the deep mantle. Several arguments repeatedly evoked to support this model include the elevated degrees and pressures of melting often characterizing hotspot basalts, the high velocity crustal roots and low upper mantle density anomalies frequently found in oceanic plateaus and aseismic ridges, and the low velocity anomalies extending from the surface to the lower mantle shown by global tomography models. However, available tomography models show that not all hotspots have deep-rooted velocity anomalies, several oceanic plateaus show neither high velocity crustal roots nor low upper mantle densities, and major and trace element and isotope ratios of some hotspot basalts indicate origin from a not necessarily hot but compositionally distinct mantle. This makes that several alternatives to the conventional plume theory have recently emerged in order to explain the origin of hotspot magmatism.

The objectives of the session are the following : (1) to characterize observational constraints on potential field anomalies, crustal structure, vertical motion, age, or geochemical composition of the anomalous structures originated by hotspot magmatism, (2) to link the surface manifestations with underlying mantle structure and dynamics, and (3) to constrain the mantle melting parameters and processes that may account for the geophysical and geochemical observations. The further purpose is to better understand the conditions and processes that may trigger and drive hotspot magmatism in order to determine if there are different types of hotspots rather than a single one (plume vs. non-plume).