Hotspots Encyclopedia Article

Hotspots

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Hotspots

Hotspots are localized areas of volcanism and high heat flow within the earth's **lithosphere** above a mantle plume hot enough to melt portions of the overriding plate. As a plate moves over a mantle plume, volcanoes previously above the plume cease to be active and new volcanoes form, creating an arcuate chain of volcanoes whose ages change progressively along the chain. The approximately 3,790 mi (6,100 km) long chain of Hawaiian volcanic islands and Emperor seamounts (submarine volcanoes) were formed by the displacement of the Pacific plate over a mantle plume. The age of volcanoes, degree of **erosion**, and general maturity of the Hawaiian Islands decreases progressively southeastward. The volcanically active Big Island overlies the present-day hotspot. The chain of volcanoes decreasing in age from west to east across the western United States and ending at Yellowstone National Park formed by the North American plate moving westward over the Yellowstone plume. Iceland lies above a hotspot at a mid-oceanic ridge.

Hotspots were thought to remain in a fixed position with respect to the earth's lower mantle. Hotspots were therefore used to define a unique, absolute reference frame to quantify the displacement of **lithospheric plates**. Maps of absolute velocity vectors for the earth's plates relative to hotspots (first produced in the late 1970s) provide a visual representation of plate motion from which the sense of displacement and resulting style of deformation at plate margins can be deduced. Hotspot tracks define segments of small circles about a fixed pole of **rotation** for the plate (called the Euler pole). Paleomagnetic studies of volcanic rocks formed above hotspots and detailed global plate reconstructions suggest that at least some hotspots may not have remained stationary. Rates of relative hotspot movement have been generally estimated at approximately 0.8–1.2 in (20–30 mm) per year. This implies that plumes may have moved with part of the mantle and displaced relative to each other. If the density distribution of the mantle changed in the past, the whole mantle may have rotated with respect to the earth's rotational axis to a new stable position (a process called true polar wander), systematically rotating all hotspots relative to the rotational axis. Paleomagnetic studies of volcanoes along hot-spot tracks are used to determine if true polar wander is likely to have occurred in the period of time recorded by the volcanoes.

See Also

Hawaiian Island Formation; Paleomagnetics