

Tectonic Magmatic Setting – Hawaiian Islands

The Hawaiian Islands are an island chain in the Pacific Ocean that were formed as the surface manifestation of mantle plume. The type of magmatic processes that occur at this locality are informed by its tectonic magmatic setting. Mantle plumes are, based off of seismic data and xenoliths and –crysts brought to the surface, sourced by deep mantle rocks as low as the core-mantle boundary around 2900 kilometers. A plume forms when enough heat sourced by the core creates a melt body large enough that its buoyant forces exceed those of the boundary between the D" layer and the overlying deep mantle. When this occurs the plume begins to rise

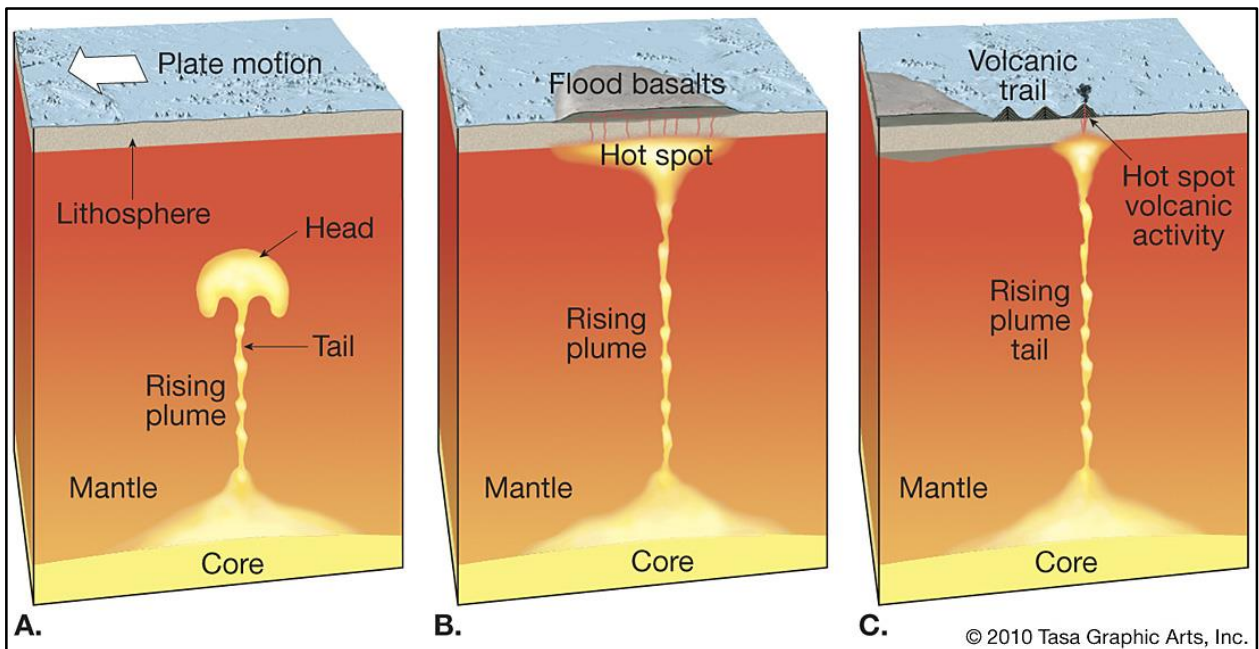


Figure 1: A theoretical model depicting a possible progression of a mantle plume rising and manifesting itself on the surface. The graphic was created by TASA, an earth science software and educational tools company.

through the overlying rock deforming and, to a small degree, melting surrounding rock as it rises. The plume itself is not a fluid column, but rather a concentration of heat energy that is continually being refueled by its source. Once the plume begins to rise it leaves a plume tail that facilitates the channeling of more heat energy up into the column (Fig. 1). This sustains and feeds the buoyancy forces of the plume as it becomes less dense with higher temperatures.

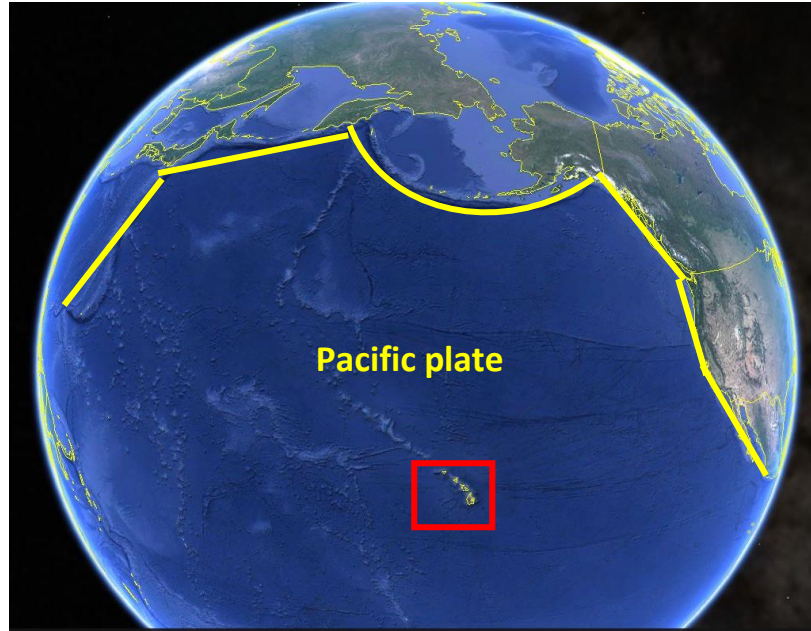


Figure 2: An image showing the Hawaiian Islands (red) that shows their intraplate location relative to the margins of the Pacific plate (yellow). (Google Earth)

In the case of the Hawaiian Islands the mantle plume rises through an oceanic lithospheric plate within the edges of plate. This denominates the setting to be an intraplate setting within the Pacific plate (Fig. 2). The general motion of the pacific plate is to the northwest where it subducts under the North American plate to form the Aleutian Arc (see exhibit) along with other convergent margin features.