THE DISTRIBUTION OF HOT SPOTS AND HYPOTHESES FOR THEIR ORIGIN

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Most of the vulcanism on earth occurs along plate boundaries; in oceanic spreading ridges, in island arc/cordilleran (Andean) zones, and in Tibetan plateau-type collisional zones. Basic rules governing the origin and distribution of these three types of volcanic activity are reasonably well defined. Other vulcanism, collectively called hotspot vulcanism, is commonly attributed either to cracking of the lithosphere and consequent rise of magma produced by partial melting of the mantle rising to fill the cracks (passive mantle hypothesis), or to chemical or physical inhomogeneities in the mantle (active mantle hypothesis). We have compiled a global map and catalogue of hot spots to help in testing the two classes of hypotheses. Although there is a great range in volume of vulcanism, amount and diameter of associated uplift, and duration of activity, there is little evidence that more than one population of objects is present. The crucial fact about the hot spot distribution is that a number occur right on the axes of spreading ridges (e.g. Iceland, Galapagos, Azores). These retain their contrast with adjacent "normal" oceanic spreading ridge (distinctive chemical and isotopic compositions, anomalous elevation, and excess volume of magmatism) despite the negligible lithosphere thickness. Some have remained approximately axial, shown by symmetrical traces, for up to 100 m.y., and they appear to control the ridge position (ridge jumping, e.g. Iceland, Galapagos). These facts are strong evidence against the various crack propagation hypotheses and the anchor-asperity model for hot spots. A thermal and /or chemical disturbance in the mantle, as originally suggested by Wilson, seems the only general hypothesis that will account for most hot spots. A few have been proposed to be the result of tensional zones generated by continental collision, but for these cases opportunism (formation of tensional zones in areas of pre-existing thinned lithosphere) has not been ruled out. A single hypothesis for hot spots (active mantle) seems inherently preferable to the many passive mantle hypotheses that have been proposed.

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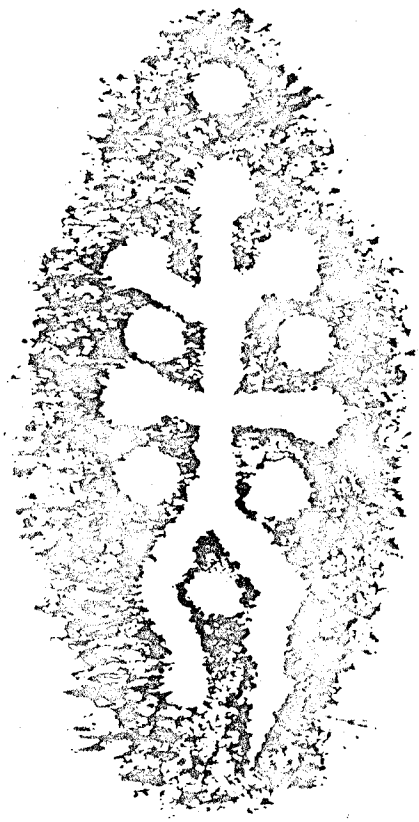

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