HOT SPOTS, HIGH SPOTS, AND OTHER TYPES OF NON-PLATE MARGIN (ANOMALOUS) TOPOGRAPHY

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A global compilation of hot spot vulcanism reveals that most active hot spots are associated with topographically high and structural elevated areas. The continental portion of the African plate displays this relationship particularly clearly, since there are a large number of hot spots on it and they are relatively well mapped. Burke and Wilson proposed that Africa has moved little over the past 25 m.y. with respect to any of the slowly moving reference frames, and we suggest that this has enabled the effects of mantle disturbances to be better displayed on this plate compared with most other areas of the earth. The diameters and amplitudes of the uplifts, and the amount of vulcanism associated with African hot spots range from large values to small, but they are not obviously correlated, since large and/or high structural uplifts are not necessarily capped by much, or any, volcanic accumulation. Thus, although the vulcanism is perhaps the most prominent feature of the hot spots, we suggest that it is of secondary importance compared to the structural uplifts (high spots) and the major active intracontinental sedimentary basins that some of them surround. Burke and Whiteman suggested that hot spot uplifts were all around 200 km across; some (e.g. Ahaggar) are somewhat larger (500 km), although a majority of the African population are close to 200 km in average diameter. Larger swells around 1000 km across seem to us to consist of groups of hot spots, although the East African swell has a lesser but still anomalous elevation between those hot spot uplifts found within it. Most of the uplift-defined hot and high spots in Africa are considerably smaller than this and cannot be readily grouped into such large 1000 km diameter swells; the same is true for a majority of the global hot spot population. A more realistic description allows a wide range of diameter and amplitude for hot spot type uplifts. Examples of high spots without associated vulcanism exist on other plates; prominent continental examples are the Adirondacks and the Putorana massif. Sub-oceanic examples include the Bermuda Rise and the northeast Pacific uplifts found by Menard. However, they (and hot spots) are almost everywhere much less prominent than on the African plate, which, we suggest, is at least partly a function of plate velocity with respect to the local mantle. High spots, like hot spots, are difficult to detect in zones of convergent tectonics and this includes the anomalous topography of Central Asia, proposed to be the result of the Indian-Asian continental collision. Other types of intraplate anomalous topography are elongate and readily distinguished and they include old collisional orogenic belts up to about 0.5 b.y. old (e.g. Urals, Appalachians), and forebulges due to lithospheric flexure in front of active thrusting zones (e.g. central India). Other unusual elongate zones of anomalous topography include one due to recent incipient convergent tectonics (E. India-Ceylon) and one (E. Baffin Island-N. Labrador) for which there is no obvious explanation or counterpart. Lithospheric thinning is the most plausible explanation for the uplifts associated with hot spots, a process that seems easily driven by mantle upwelling under the hot and high spot sites.

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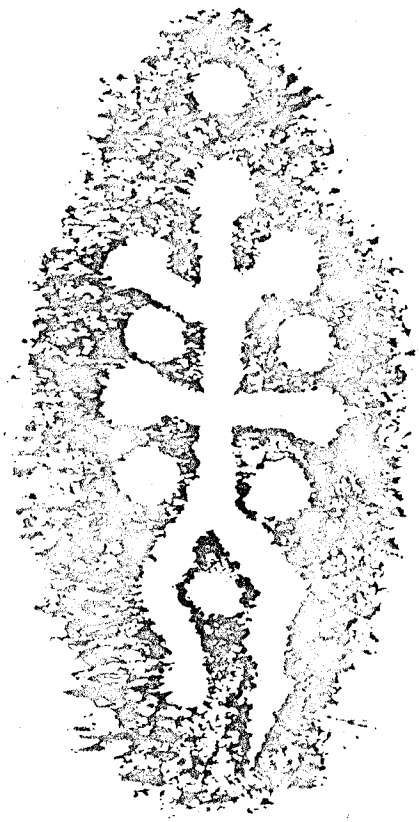

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