g6 Hotspots and aseismic ridges < Wilson, Hawaiian and Walvis ridges>

> Tuzo [Wilson]'s mind had a fascinating way of solving problems. Unlike most physicists, who find their solutions via mathematics, Tuzo solved problems almost entirely with visual images and then presented the solutions in extremely clear prose. He had a remarkable ability to look into the heart of extreme complexity and see simplicity itself. The nearest mind that I can think of to compare with Tuzo's was that of Michael Faraday who, instead of integrating differential equations to calculate the electric field, imagined a charged particle to be an octopus with tentacle-like lines of force reaching out into the space around it.
>
> To solve the problem of the origin of the Hawaiian Islands, for example, Tuzo imagined someone lying on his back on the bottom of a shallow stream, blowing bubbles to the surface through a straw.
>
> The bursting bubbles were the Hawaiian Islands, and they lay in a line because they were swept along the surface by the moving stream. —Derek York.[1]

> Wilson recalls that 'the turning point' in his conversion to continental drift 'was the receipt of a copy from Sam Carey of his mimeographed paper [2] from the [1956] Tasmanian [drift] symposium.' [3]
>
> —William Carnell Erickson.[4]

Tuzo Wilson reviews:[5] "The notion that ocean basins have spread from mid-ocean ridges was advanced by Holmes ([1928,] 1931) and Hills (1947) and used in both editions of Holmes' textbook. lt received impetus from the discovery by Ewing & Heezen (1957) of the continuity of mid-ocean ridge system. This led to the greatly improved views on spreading of Hess (1962) and Dietz (1961)." In 1962, a test for seafloor spreading occurred to Tuzo (to use his preferred moniker). This was that central-vent volcanoes formed one after the other at a ridge hotspot are carried away from their feeding conduit to become a trail of extinct volcanic island, seamounts, and guyots. These will date older the further they are from the ridge. Tuzo had acquired dates from the literature for 40 volcanic islands. Their distributions he found were consistent with seafloor-spreading hypothesis predictions.

Tuzo's first scholarly paper on his test of the hypothesis of seafloor spreading accounted for the Hawaiian archipelago as a trail of volcanoes from a hotspot far from a ridge but which is stationary as it is located deep in the mantle below the asthenosphere that flows bearing oceanic crust that forms at the ridge. This was refused publication by the *Journal of Geophysical Research* (as it contained no mathematics and the information marshaled was meager) but in 1963 it received publication in the *Canadian Journal of Physics* [6] (of which he, Wilson, was the editor). A second paper, published in *Nature* in 1963,[7] focused on two aseismic ridges in the South Atlantic that from Tristan da Cunha active-volcanic island (the last major eruption there was in 1961)[8] trail away: the Walvis Ridge northeast toward Africa, and the Rio Grande Rise northwest toward South America. These aseismic ridges are not at right angles to the seismic mid-ocean Atlantic ridge. This indicated that the existing seafloor spreading model, which presumed flow to be at right angles to the ridge, needed modification. By 1965, Tuzo relegated flow to below the crust that moved as a "plate", and so not necessarily in the direction of the local flow beneath. The term would reemerge at the end of the 1960s in "plate tectonics" which models the crust and top-most part of the mantle as *lithosphere* that moves upon a yielding *asthenosphere* (the low-velocity layer of seismology within the upper mantle).

Hotspot volcanism is the extrusive surface expression of magma generation by partial melting of mantle rock. One possibility is intraplate stress related to partial melting (*see* Topic *g8*). An older view subscribes to adiabatic decompression melting in the head of a rising plume of mantle rock. The question then is: from what depth do such plumes rise? An answer by Raffaella Montelli in 2004 is that P-wave velocity images (from Finite-Frequency Tomography) indicate two different mantle convection depth regimes with: 1) several plumes that are mostly confined to the upper mantle, and 2) plumes that extend from the lowermost mantle (as are below Ascension-St Helena-Tristan da Cunha, Azores, Canary, Easter, Samoa, and Tahiti) and "other less well-resolved plumes, including Hawaii, that may also reach the lowermost mantle."[9] ❑