# SEAMOUNT CHAINS RESULT FROM EPISODIC CHANGES IN IN-PLATE STRESS THAT OPEN CRACKS THROUGH THE LITHOSPHERE AND PERMIT MAGMA ASCENT : THEY DO NOT REQUIRE PLUMES

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Newer data support, as an alternative to the plume/hotspot hypothesis for seamount chains, formation via in-plate, stress-generated cracks through the lithosphere, first discussed by Jackson et al. (1972, 1975). Many Pacific mid- to late Cenozoic seamount chains comprise intermittently spaced volcanic ridges, in some places aligned en echelon to the overall trend of the chain, a pattern that reflects tensional and shear stresses in the lithospheric plate. The overall trend is a line of incipient cracking, generally close to the average direction of plate motion in the fixed-Antarctica reference frame. These chains are not copolar nor do they have the same angular rate of progression. By contrast, Early Cenozoic and Cretaceous chains are not demonstrably aligned in the directions of plate motion nor were the volcanoes in a chain formed at the same paleolatitude. The ridges mark episodic deviations in the stress field, permitting cracks to open through to the asthenosphere. The upper parts of the asthenosphere are at the solidus temperature, as manifested in seismic velocities indicating the presence of small fractions of melt. Cracks allow magmas to ascend to the surface where they erupt to form the volcanoes and ridges. Fertility variations in the asthenosphere favor large volumes of magma along cracks suitably situated. Massive volcanoes commonly conceal their narrow-ridge origins. Variable melt volumes from the heterogenous “plum-pudding” upper mantle provide the full range of compositions represented in seamount rocks. Heat-flow and lava-composition data do not support the notion of hotspots: temperatures are not greater than normal. Cracks typically break through in younger parts of the lithosphere, which are thinner and weaker than older lithosphere, but cracking is possible anywhere the lithosphere is thin or weak or the tensional stresses adequate. Cracking is common, for example, along the thinned lithosphere of the boudinage-like structures imaged on regional gravity maps, as in the Pukapuka chain, which follows one of the regional gravity lows. There, as in several other chains, the time sequence of volcanic ridges is not progressive. Bouyant magma can actually magma-fracture the overlying plate even if it , in the absence of melt, could retain its integrity. The crack mechanism requires no excessive "hotspot" temperatures and no plumes.