plates whose apparent rigidity may be attributed to extensive uniform stress fields and low stress gradients. Global geotectonic history is probably marked by change from high-order symmetry reflecting vertical movements to low-order symmetry shown by more recent lateral and predominantly westward movements, of lithosphere plates.

T118

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Fracturing in Lithospheric Plates by Magma Induced Pressure. An exact solution of three dimensional elasticity in an infinite media is used to calculate the effects of magmatic pressure on the surrounding lithospheric plates due to discrete prolate magma bodies with a width to depth ratio of 1 : 1.4, 1 : 10 and 1 : 100. The Poisson's ratio of various lithospheric rocks is considered ≈ 0.3. Although radial and concentric fractures are found to occur in all the cases considered, for bodies of 1 : 1.4, radial fractures predominate over the whole domain of pressures. In the other two cases, when the excess of magma pressure is relatively small compared to the lithostatic pressure, steeply dipping concentric fractures become restricted in a narrow zone near the apex of the magma chamber while the radial fractures predominate in a wide marginal area. At higher magnitudes of magma pressure, vertical fractures develop close to the apex of the magma body which, with increasing stress, tend to diverge into funnel or cone shaped shear fractures ($\approx 60°$ for body of 1 : 10, and $\approx 50°$ for 1: 100) or echelon arrays of vertical tensile fractures. These results indicate that faults and fracture patterns in lithosphere due to deep-seated magmatic body, dike swarms around volcanic neck, and the funnel shape of the layered ultramafic-mafic complexes, etc., can be correlated satisfactorily with the shape and size of the magma body, and its relative effective pressure at depth.

T119

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Runaway Temperatures in the Asthenosphere Resulting from Viscous Heating. The analogies between thermal runaways in the asthenosphere and thermal explosions in solid explosives are pursued. It is shown that the potential for thermal runaways exists everywhere in the asthenosphere. If a thermal runaway is triggered, a surge of hot material rises to the lithospheric-asthenospheric boundary. This surge will spread out horizontally and sink as it cools, producing reverse flow, stagnation points, and hot spots. This creates zones of partial melting leading to irregular patterns for the inception of volcanism, concentrations of volatiles, variation of magma types, and disturbance of the thermal regime below the lithosphere. It is suppested that important changes in plate boundaries, such as the breakup of continents and the collision of a ridge and a trench, will trigger thermal runaways. The lifetime of the thermal runaway is estimated to be a few tens of millions of years.

T120

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Hot Spots and the Driving Mechanism. Early analyses indicated that hot spots (high areas of non-plate-margin vulcanism) were few (~ 20) in number, fixed with respect to each other and localized near triple junctions. We recognize many (~ 120) hot spots, some of which have moved with respect to each other and we observe concentrations of active hot spots on the African and Chinese slowly moving plates. Hot spots are found at, or near, a majority of triple junctions of types RRR, rrr, RRF, RrF and RRr. Junctions of aulacogens and failed rift arms with oceans and orogens are evidence that rrr triple junctions over hot spots have been consistent associates of the plate tectonic behavior of the earth's lithosphere throughout the past 2×10^9 years. Known hot spot volcanic lives range from 2×10^7 years to 2×10^8 years; some erupt continuously while others are intermittent. If hot spots are related to upward movement of deep mantle material, they indicate that this motion is complex, highly irregular and probably, because there are so many hot spots, relatively rapid.

T121

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Numerical Studies on the Structure of Mantle Plumes. To determine possible structures of mantle plumes, numerical studies have been made of thermal convection in a cylindrical geometry for large Prandtl number. The numerical method is first order explicit and fully conserving. Steady state flows generated by both base heating and internal heating have been investigated for a range of Rayleigh numbers using a diffusion controlled viscosity with a strong dependence on temperature and pressure. The thermal and velocity structure of flows for conditions relevant to base heated convection in the upper mantle above 700 km and to internally heated convection over the whole mantle are determined. A rising thermal plume is formed for base heated convection, but with internal heating a broad region of rising flow with a narrow descending plume at its periphery is observed. Partial melting of mantle material is predicted in regions of ascending flow. The depth of the solidus and the degree of melting are estimated and discussed in terms of current theories of basalt magma genesis. The rate of magma generation and the surface area over which rising magma could cause volcanism are also discussed and compared with rates of magma generation and the "melting spot" size for the Emperor-Hawaii island chain.

T122

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Steady Motions of Lithospheric Plates Driven by Continental Heat Sources. If an isolated lithospheric plate has both continental and oceanic portions, it will move with constant velocity through an asthenospheric pond. The velocity of self-propulsion of such a lithospheric 'boat' is proportional to the heat flow in the continents if the mechanism of heat dissipation in the asthenosphere is conduction, i. e. for small amounts of heat flux. For large heat flux, the velocity is proportional to the square root of the heat flux whether convection or viscous dissipation is dominant. Viscous dissipation in the asthenosphere can be neglected if the dimensionless number gh/V_s^2 is small, where h is the thickness of the asthenosphere and V_s is the shear wave velocity is the asthenosphere. The detailed mathematical theory has shown good agreement with model experiments. For reasonable values of properties of the asthenosphere, velocities of the order of

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Cover Portion of a group photo taken at the Twelfth Annual Meeting held in Washington, D.C., April 30 and May 1, 1931. Number 38 is the present general secretary, Charles Whitten. In the foreground, numbers 39 and 43, are William Bowie and John Adam Fleming.

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