DECOMPOSITION OF HELIUM AND HYDROGEN COMPOUNDS FUELLING VOLCANIC ERUPTIONS AND EARTHQUAKE

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Most volcanic eruptions and earthquakes occur on deep-seated faults at plate boundaries. Both are outbursts of tectonically-directed energy of an essentially unknown nature, accompanied by exhalations of mantle-derived helium and hydrogen. There are no convincing explanations for the generation of magma chambers in the earth's crust, and no convincing model for earthquakes, or their preceding geochemical, geophysical and thermal anomalies.

Primordial compounds of He-H, He-O, He-Si, He-C, He-N and He-metals, stable only at temperatures higher than 1000 K and pressures above 14 Mpa, are proposed as a possible fuel for both. The decomposition of these compounds may be caused by decompression of the fault-zone by external effects (e.g., accumulated influence of tidal waves causing fatigue fracturing), and would release huge amounts of energy (more then 2 kkal/g-mol for the He-H decomposition). In the case of slow decomposition, the liberated energy would result in heating and melting of lower crustal or mantle material, thus preparing volcanic chambers. The quick decompression would produce explosions and earthquakes. If the pressure-rise in the potential earthquake hypocenter is not sufficiently strong for rock destruction, a pressure balance would be achieved and the He-liberation process will cease.

He- and H-compounds in the earth's interior must be of primordial origin, since both are among the most abundant elements in the original solar nebula. The stability of the planet earth as an open thermodynamic system depends on its having a minimum of free energy. The formation of He- and H-compounds would act as an energy-storing process and as a cooling system, because of their very large energy capacity. It is possible that mantle matter behaves both as a brittle solid and as a liquid, depending on a type of pressure applied (e.g., salt or asphalt). He-migration by phase-transfer from solid and solution in the earth's core, through a series of compounds in the mantle, to He- and H-compounds in the lithosphere, and the final decomposition of these compounds in deep-seated faults, is the quickest possible process of energy transfer.

A pressure increase at earthquake hypocenters may, in theory, be monitored by the correlation of primary and secondary wave propagation in "seismic gap" areas. The changes of geophysical fields together with the succession of characteristic geochemical processes at the hypocenter, may also be monitored, thus providing a method for the short-term prediction of earthquakes and volcanic eruptions.