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Crustal Magnetic Field Anomalies and Global Tectonics

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A wide variety of evidence suggests that the ruling isochron (geomagnetic polarity versus age) hypothesis of marine magnetic lineations has no merit - undermining therefore one of the central tenets of plate tectonics. Instead, variable induction by the ambient geomagnetic field is likely to be the principal agent for mega-scale crustal magnetic features - in both oceanic and continental settings. This revitalizes the fault-controlled susceptibility-contrast model of marine magnetic lineations, originally proposed in the late 1960s. Thus, the marine magnetic 'striping' may be ascribed to tectonic shearing and related, but variable, disintegration of the original iron-oxide mineralogy, having developed primarily along one of the two pan-global sets of orthogonal fractures and faults. In this way, fault zones (having the more advanced mineral alteration) would be characterized by relatively low susceptibility, while more moderately affected crustal sections (located between principal fault zones) would be likely to have less altered oxide mineralogy and therefore higher magnetic susceptibility. On this basis, induction by the present geomagnetic field is likely to produce oscillating magnetic field anomalies with axis along the principal shear grain.
The modus operandi of the alternative magneto-tectonic interpretation is inertia-driven wrenching of the global Alpine age palaeo-lithosphere - triggered by changes in Earth's rotation. Increasing sub-crustal loss to the upper mantle during the Upper Mesozoic had left the ensuing Alpine Earth in a tectonically unstable state. Thus, sub-crustal eclogitization and associated gravity-driven delamination to the upper mantle led to a certain degree of planetary acceleration which in turn gave rise to latitude-dependent, westward inertial wrenching of the global palaeo-lithosphere. During this process, 1) the thin and mechanically fragile oceanic crust were deformed into a new type of broad fold belts, and 2) the continents were subjected to relative 'in situ' rotations (mostly moderate). Examples of marine magnetic lineations with landward continuation along prominent transcurrent fault zones, and the fact that striped marine magnetic anomalies may display orthogonal networks – concordant with the ubiquitous system of rectilinear fractures, faults and joints – corroborate the wrench tectonic interpretation of crustal field anomalies.