Geophysical Research Abstracts, Vol. 6, 06235, 2004
SRef-ID: 1607-7962/gra/EGU04-A-06235

SLAB-TRANSFORM EDGE PROPAGATOR (STEP) FAULTS: DYNAMIC CONSEQUENCES AS INFERRED FROM MODELING

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Slab edges are currently a relatively common geometrical feature in plate tectonics (e.g., Tonga, New Hebrides, Scotia plate, Lesser Antilles, Ionian Sea). Near such horizontal terminations of subduction trenches, ongoing tearing of oceanic lithosphere is a geometric consequence. We use 3D mechanical models to investigate whether STEP faults are stable plate tectonic features and what surface observations may be expected at STEPs. Based on the great variety of plate tectonic configurations in which slab edges occur, we investigate various end-member cases for the forcing, geometry and mechanical properties.
We conclude that STEP faults in most circumstances are stable features that may exist for several million years. In the (probably rare) cases that the resistance to fault propagation is high, slab break-off will occur. At the model surface, substantial paleomagnetic rotations and velocities are predicted, consistent with observations in for instance the Mediterranean region. Predicted stress orientations agree with seismologically well-constrained focal mechanisms on northern Tonga.