2017 Geodynamics Seminar

Origin of Transform Faults and Gravity Rolls

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Carriage House, Quissett Campus, WHOI

Talk Summary

Thermal subsidence of the oceanic lithosphere is the dominant signature of the ocean basins. The lithosphere contracts by about 1% in all three dimensions as it cools. The lithosphere is free to contract in the vertical and spreading directions. However ridge-parallel contraction will produce large thermoelastic stress and strain [Collette, 1974; Turcotte, 1974] that affects plate motion circuits [Kumar and Gordon, 2009]. Much of the ridge-parallel strain could be accommodated at transform faults. If the lithosphere is free to contract in the two horizontal dimensions then large thermoelastic bending moments will develop with compressional stress at shallow depth and extensional stress deeper in the plate [Haxby and Parmentier, 1988]. This bending moment is optimally released by lithospheric flexure between regularly spaced parallel cracks forming low-amplitude corrugations in seafloor depth and gravity [Sandwell and Fialko, 2004]. These cracks provide conduits for the generation of volcanic ridges in agreement with observations from satellite-derived gravity. Improved seafloor mapping and lithospheric imaging are needed to test the thermo-elastic model for the formation transform faults and gravity rolls.

Before jumping into this rather controversial subject, I'll start the talk with a status report on achieving a 1-mGal accuracy, global marine gravity grid using the latest radar altimetry data from CryoSAT-2 and AltiKa.