Geophysical Research Abstracts
Vol. 21, EGU2019-10604, 2019
EGU General Assembly 2019

Oblique mantle flow beneath 'orthogonal' ridge-transform intersections

Lars Ruepke (1), Ingo Grevemeyer (1), Jason Morgan (2), Colin Devey (1), and Sonja Theissen-Krah ()
(1) GEOMAR, Germany (lruepke@geomar.de), (2) Royal Holloway, UK

Oceanic transform faults offset mid-ocean ridges by up to several hundred kilometers. In the theory of plate tectonics, they are defined as conservative, pure strike-slip boundaries. It is unclear exactly how the viscous mantle responds to this sharp discontinuity in crustal production.
Here we present results from geodynamic simulations using ASPECT to examine mantle and melt movement. Our three-dimensional simulations show oblique mantle flow patterns emerging in simulations assuming a non-linear stress-dependent rheology. Instead of the classic symmetric corner flow-type mantle flow with a sharp strike-slip boundary along the transform fault, a strong asymmetry in mantle upwelling develops beneath the ridge-transform intersections (RTI). This flow is directed from beneath the inside towards the outside corner of the RTI and results in the transfer of mantle material to the opposite side of the ridge. A likely implication of this is that melt migration will also be asymmetric with melt focusing towards the outside corner, possibly explaining why transform faults are so deep and so rarely show clear signs of intra-transform magmatism. These theoretical insights suggest that crust formed near the RTI will have a complex geological history and that crustal accretion is likely to be asymmetric.