EGU21-2261
https://doi.org/10.5194/egusphere-egu21-2261
EGU General Assembly 2021

Transform faults revisited- a global approach

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Oceanic transform faults are seismically and tectonically active major plate boundaries. Their inactive traces are called fracture zones and may cross entire ocean basins. Plate tectonics idealizes transforms to be conservative two-dimensional strike-slip boundaries where lithosphere is neither created nor destroyed, and along which the lithosphere cools and deepens as a function of plate age. Here, we present constraints from a new compilation of high-resolution multibeam bathymetric data from 41 oceanic transforms covering all spreading rates. Statistical data show that all transform faults are considerably deeper than adjacent spreading segments and that the depth of transform valleys increases with decreasing spreading rate. The trend of increasing transform depth seems to be governed by age-offset. Further, accretion at ridge-transform intersections appears strongly asymmetric, with outside corners showing shallower relief and more extensive magmatism while inside corners have deep nodal basins and appear magmatically starved. We use a three-dimensional viscoplastic numerical model to survey the relationship between transform depth and age-offset and use high-resolution bathymetric data to study the interaction between adjacent spreading segments and transform faults at their intersection, the ridge-transform intersection or RTI. Our global compilation of multibeam bathymetry suggest that processes acting at RTIs are independent of spreading rate, contradicting deductions from gravity field observations which seemed to imply a strong spreading rate dependence of processes shaping transform faults and fracture zones.