EGU22-2279
https://doi.org/10.5194/egusphere-egu22-2279
EGU General Assembly 2022

The Oceanographer transform fault revisited – preliminary results from a micro-seismicity survey reveals extensional tectonics at ridge-transform intersections

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Fracture zones were recognized to be an integral part of the seabed long before plate tectonics was established. Later, plate tectonics linked fracture zones to oceanic transform faults, suggesting that they are the inactive and hence fossil trace of transforms. Yet, scientist have spent little time surveying them in much detail over the last three decades. Recent evidence (Grevemeyer, I., Rüpke, L.H., Morgan, J.P., Iyer, K, and Devey, C.W., 2021, Extensional tectonics and two-stage crustal accretion at oceanic transform faults, Nature, 591, 402–407, doi:10.1038/s41586-021-03278-9) suggests that the traditional concept of transform faults as being conservative (non-accretionary) plate boundary faults might be wrong. Instead, transform faults are always deeper than the associated fracture zones and numerical modelling results suggest that transform faults seem to suffer from extensional tectonics below their strike-slip surface fault zone. During the cruise M170 of the German research vessel METEOR early in 2021, we aimed to test this hypothesis by collecting, in a pilot study, micro-seismicity data from the Oceanographer transform fault which offsets the Mid-Atlantic Ridge by 120-km south of the Azores near 35°N. Preliminary analysis of 10-days of seismicity data recorded at 26 ocean-bottom-seismometers and hydrophones showed 10-15 local earthquakes per day. Along the transform fault the distribution of micro-earthquakes and focal mechanisms support strike-slip motion. However, at both ridge-transform intersections seismicity does not mimic a right-angular plate boundary; instead, seismicity occurs below the inside corner and focal mechanism indicate extensional tectonics. Therefore, micro-seismicity supports features found in numerical simulations, revealing that transform faults have an extensional as well as a strike-slip component.