Geophysical Research Abstracts
Vol. 19, EGU2017-14013-1, 2017
EGU General Assembly 2017

Robust measurement of anisotropy in the mechanical strength of oceanic lithosphere

Lara M. Kalnins (1) and Frederik J. Simons (2)

(1) School of GeoSciences, University of Edinburgh, Edinburgh, United Kingdom (lara.kalnins@ed.ac.uk), (2) Department of Geosciences, Princeton University, Princeton, NJ, USA

The mechanical strength of the lithosphere, typically measured by analogue to a purely elastic plate with thickness T_e, is a key geodynamic parameter that modulates, and in turn is modulated by, many key tectonic processes, including rifting, orogeny, and volcanism. The anisotropy inherent in these processes leads to a natural expectation that the resulting material strength of the lithosphere may also be anisotropic, which will in turn influence future deformation and volcanic activity.

Anisotropy in the strength of continental lithosphere has been studied by a range of authors, but anisotropy in oceanic T_e remains nearly unstudied, despite the highly anisotropic nature of its formation at mid-ocean ridges. Here, we extend our robust analysis of anisotropy in continental T_e (Kalnins et al., 2015) to the oceanic domain. We look to develop a robust method optimised for oceanic structure and datasets that consistently identifies and removes spurious measurements of anisotropy, leaving only those directions that are both mathematically and geophysically significant. We compare results from free-air admittance, more commonly used in the oceans, with Bouguer coherence, widely used in the continents, and hence used for previous studies of anisotropy in T_e. We also consider the influence of different available marine datasets, particularly the use of bathymetry datasets that include gravity-derived data. Accurately identifying anisotropy in the strength of the oceanic lithosphere is key in understanding how spreading rate, fracture zone dynamics, and flow in the upper mantle, as well as normal maturation of oceanic lithosphere, influence the evolving strength profile of the lithosphere. Anisotropy may also have a role to play in how intraplate volcanism and subduction both influence and are influenced by the strength of the local lithosphere.