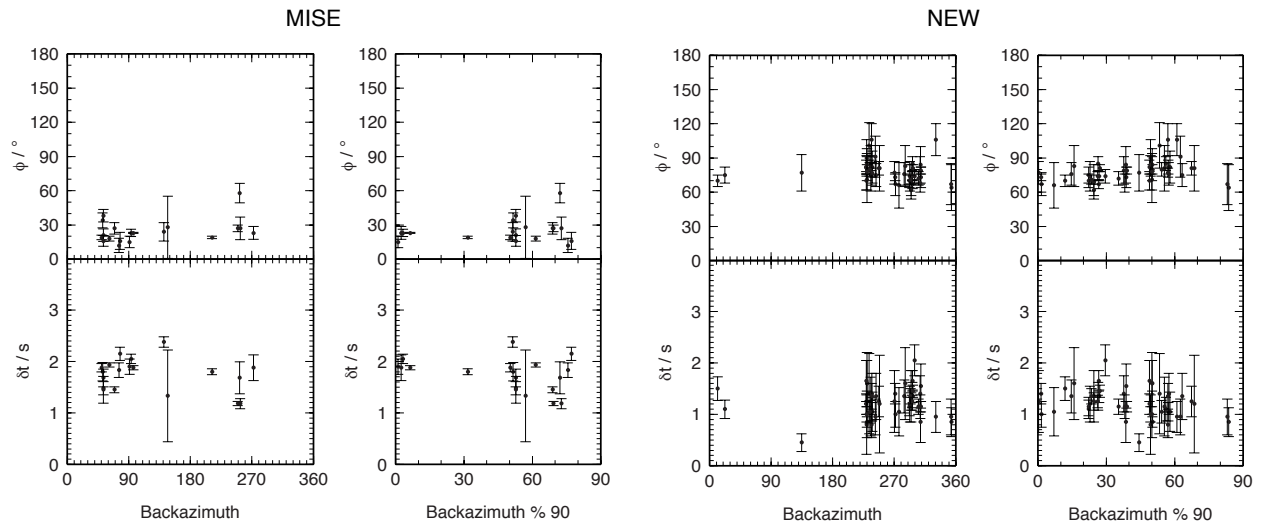


# Supplementary Information to: Mantle anisotropy beneath the Earth's mid-ocean ridges

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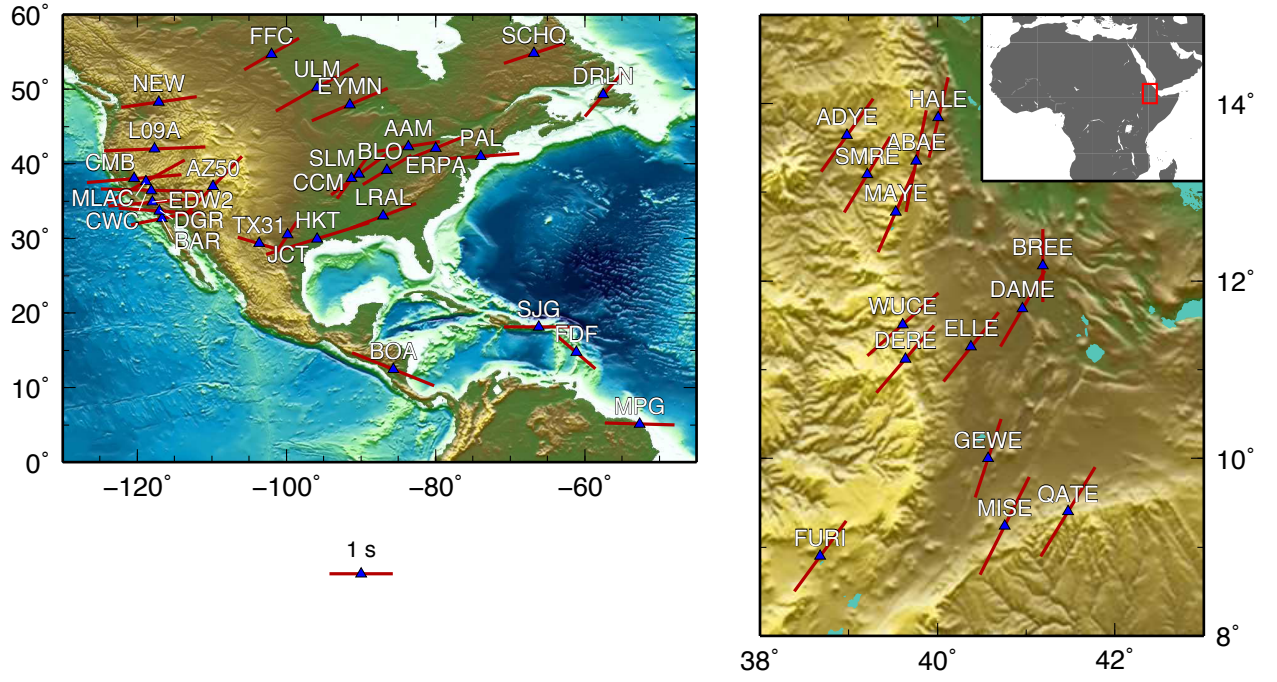


**Supplementary Figure 1:** SKS splitting measurements at stations MISE, Mieso, Oromia, Ethiopia (J.O.S. Hammond, pers. comm., 2010) and NEW, Newport, Washington, USA (Liu, 2009). Shown are measurements for backazimuths 0–360° (left panels), and backazimuth modulo 90° (right panels). Errorbars show  $2\sigma$  uncertainties. Both stations show consistent splitting parameters across a range of backazimuths, with no apparent 90° periodicity.

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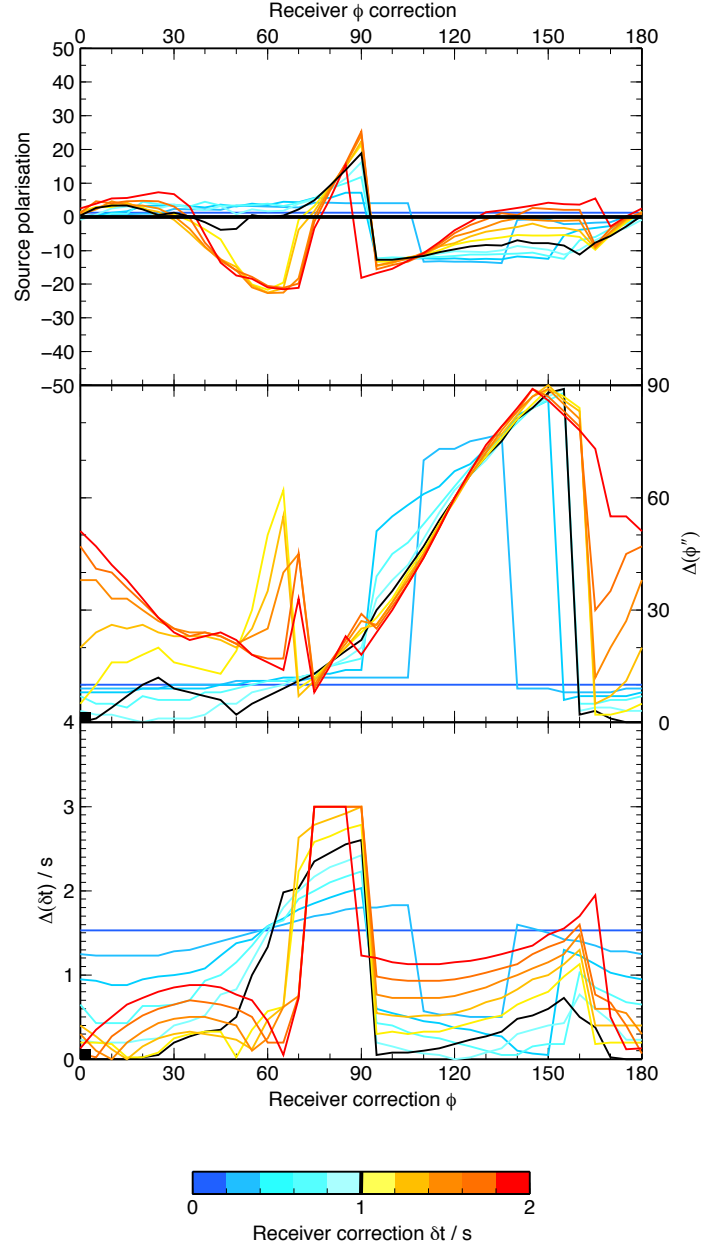
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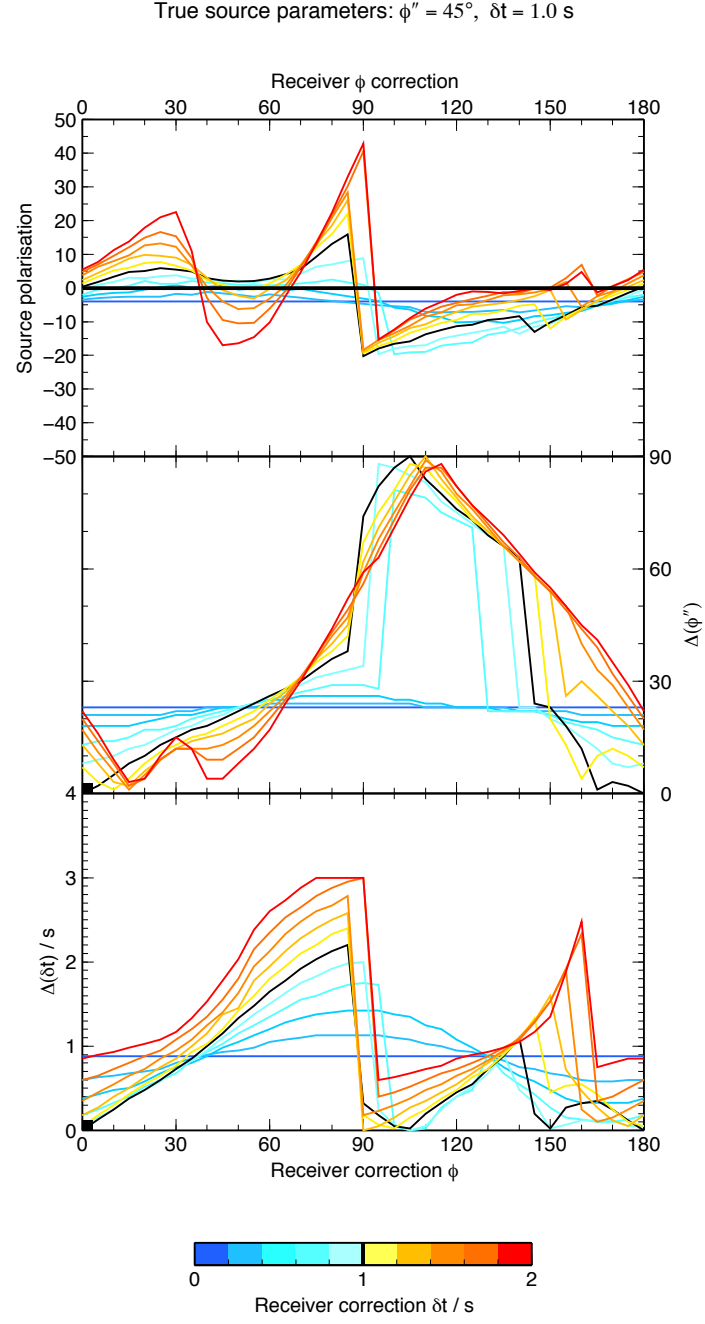


**Supplementary Figure 2:** Stations used in this study, with the SKS splitting parameters used as receiver corrections shown by red bars. Length is proportional to  $\delta t$  as shown by the legend, and  $\phi$  is indicated by orientation. Left: American stations from Liu (2009), apart from: AAM (Fouch et al., 2000); DRLN (Barruol et al., 1997); SCHQ (Niu and Perez, 2004) Right: Inset map shows location of larger-scale figure of Ethiopian stations. Stations from J.O.S. Hammond (pers. comm., 2010), except FURI (Ayele et al., 2004). Station DRV (Base Dumont Durville, Terre-Adelie, Antarctica) is not shown:  $\phi_{\text{SKS}} = 88^\circ$ ,  $\delta t = 1.2 \text{ s}$ . (Barruol and Hoffmann, 1999)

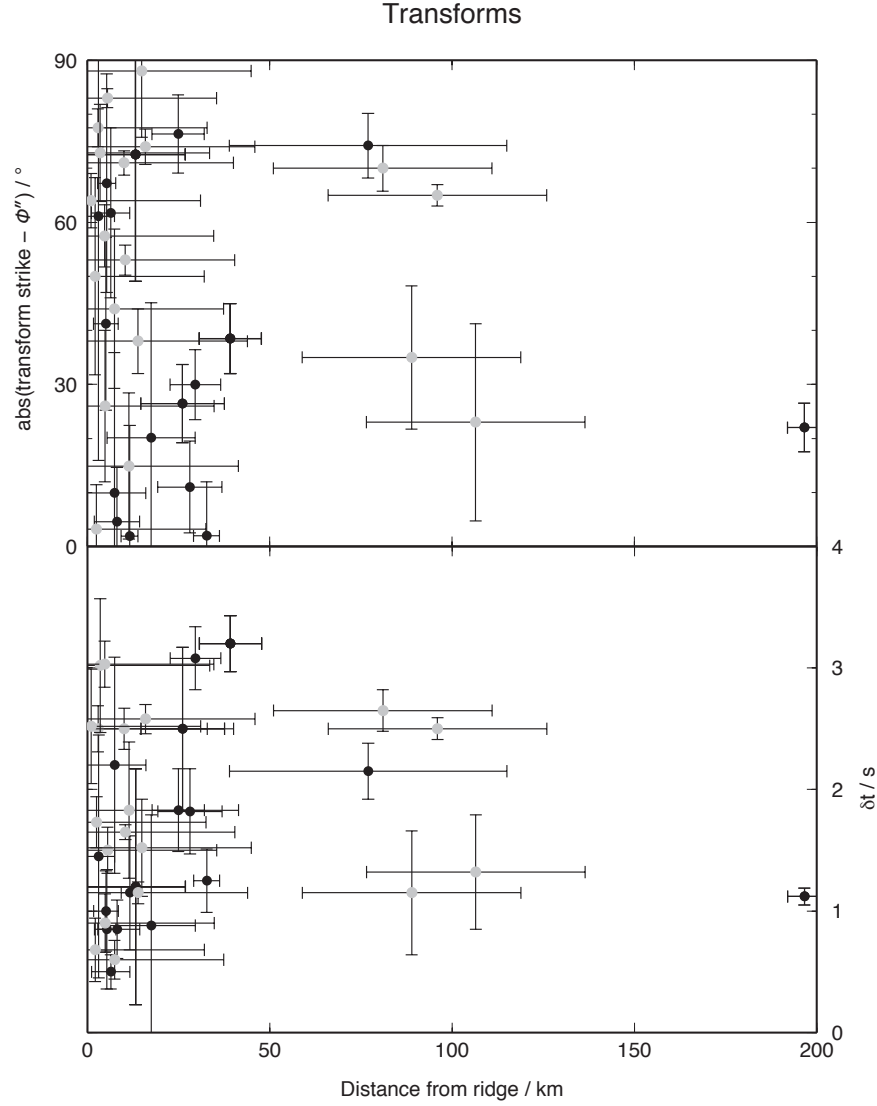
True source parameters:  $\phi'' = 20^\circ$ ,  $\delta t = 1.0$  s



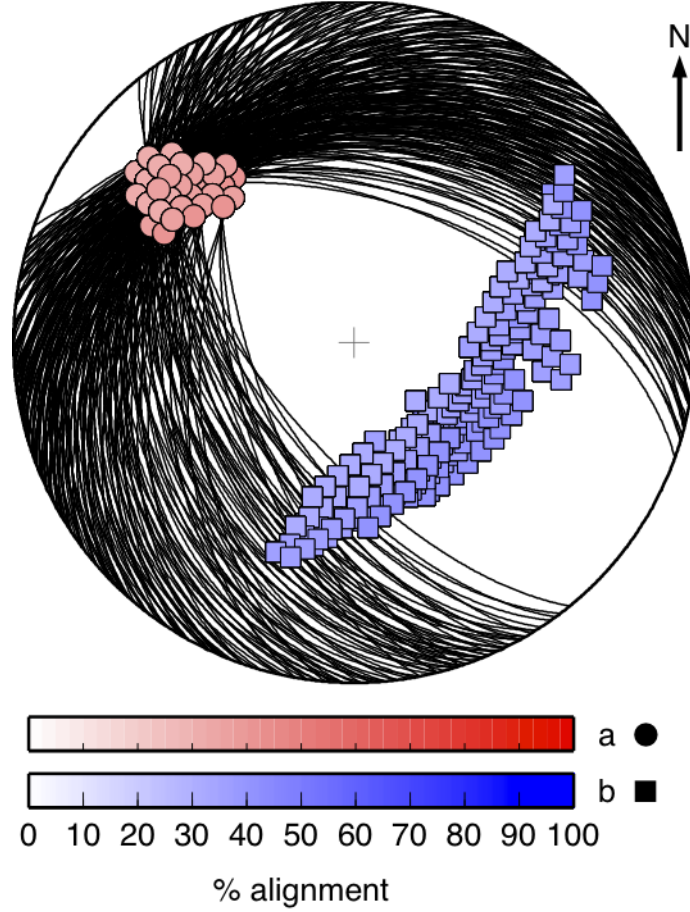
**Supplementary Figure 3:** Difference between true and recovered splitting parameters and measured initial source polarisations for synthetic shear waves with an imposed case of two-layer splitting and a range of trial values as corrections for the second layer. The coloured curves—where colour shows the trial receiver correction delay time,  $\delta t_r^{\text{trial}}$ —are the difference between recovered and true splitting parameters for the source,  $\Delta(\phi'')$  and  $\Delta(\delta t)$ , for a range of trial receiver fast orientations,  $\phi_r^{\text{trial}}$ . The true receiver parameters are  $\phi_r^{\text{true}} = 0^\circ$  (shown by the black square, lower left in the figures) and  $\delta t_r^{\text{true}} = 1.0$  s (shown by the black line). True source parameters are  $\phi_s^{\text{true}} = 20^\circ$ ,  $\delta t_s^{\text{true}} = 1.0$  s. See main text for further information.



**Supplementary Figure 4:** As for Supplementary Figure 3, but for a case where  $\phi_s^{\text{true}} = 45^\circ$ ,  $\delta t_s^{\text{true}} = 1.0$  s.



**Supplementary Figure 5:** Variation in splitting parameters with distance from nearest ridge segment for events classified as on transforms. Upper diagram shows the absolute difference between the source fast orientation,  $\phi''$ , and the strike of the transform. Dark circles show EHB relocations; light circles represent ISC locations. Error bars show published uncertainty in earthquake locations.



**Supplementary Figure 6:** Orientations of olivine a- and b-axes, and b-planes, compatible with observations at the Doldrums Fracture Zone, Mid-Atlantic Ridge. As for Figure 7 of main text, except shown are orientations which predict splitting within twice the errors of the shear wave splitting measurements quoted in the main text. The a-axes still predominately trend along an azimuth of  $\sim 310^\circ$ , dipping about  $28^\circ$ . FZ strike and TTI plane not shown.

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