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# Do Transform Faults Parallel Plate Motion?

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The rigid plate hypothesis implies that oceanic lithosphere does not contract horizontally as it cools (hereinafter "no contraction"). An alternative hypothesis is that vertically averaged tensional thermal stress in the competent lithosphere is fully relieved by horizontal thermal contraction (hereinafter "full contraction"). These two hypotheses predict different azimuths for transform faults, which we compare for azimuths of 140 globally distributed transform faults. Differences are as large as 2.44°, but more typically are $\leq$1.0°. We determine the sum-squared normalized misfit for various values of $\gamma$, which we define to be the fractional multiple of the predicted difference in azimuth between full contraction and no contraction. $\gamma$ = 1 corresponds to full contraction, while $\gamma$ = 0 corresponds to no contraction. The sum-squared normalized misfit is minimized for $\gamma$ = 0.9 $\pm$0.4 (95% confidence limit). We conclude that significant horizontal thermal contraction occurs in young oceanic lithosphere that displaces the walls of transform valleys relative to the stable plate interior, which in turn causes a small but significant bias in the azimuths of the transform faults. Thus plates are not rigid and transform faults do not parallel plate motion, although these remain good approximations.