To view the figure's layers in the PDF version of this paper, open the PDF in Adobe Acrobat or Adobe Reader. To view the layers while reading the full-text version of the paper, click https://doi.org/10.1130/GES01488.I5 to download a PDF of the figure.

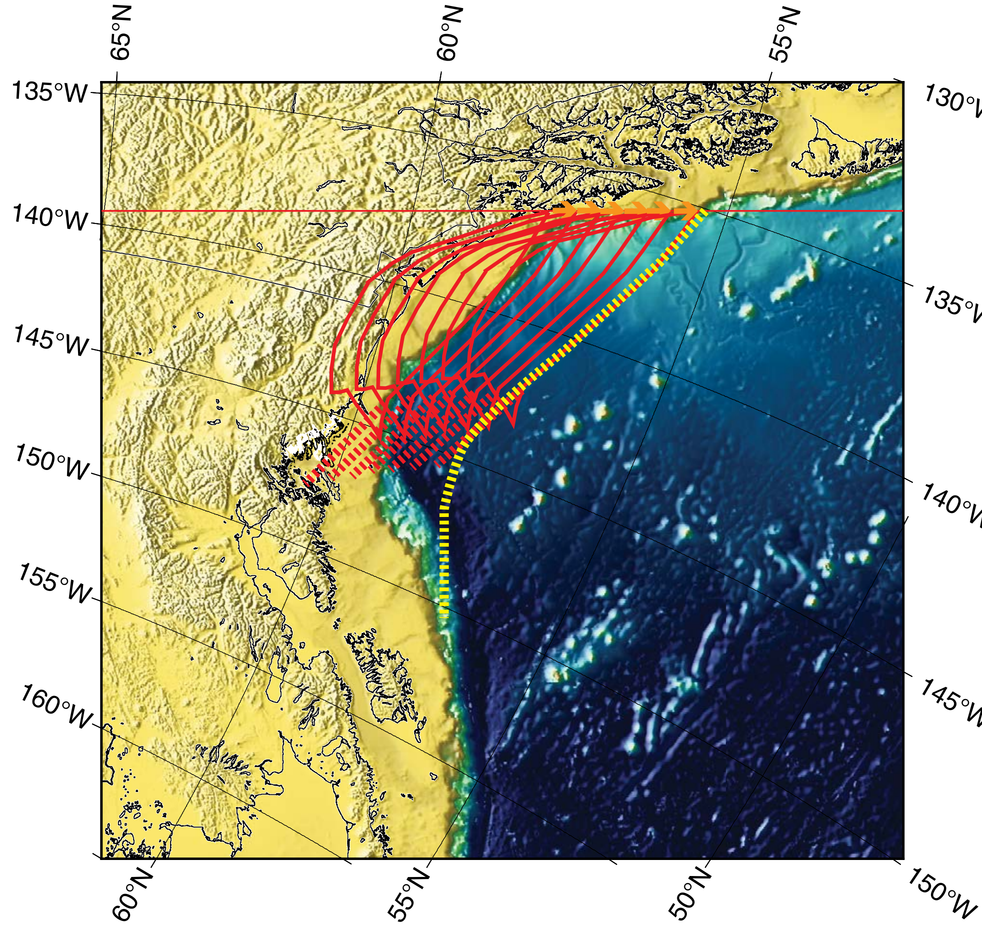

Figure 12. Reconstruction of Alaska coastline to 6 Ma. This figure is a layered PDF with the layers providing a simple form of time animation at 1 m.y. intervals. The red polygon is the outline of the Yakutat microplate identical to that drawn in Figure 11. The one on the left is the current geometry (drawn black in Fig. 11), and the one to the right is the same polygon back projected to 6 Ma using the pole of Elliott et al. (2010). The dashed red line is a westward projection of the Transition fault to the area where Kim et al. (2014) image a feature interpreted as the boundary between Yakutat and Pacific lithosphere. The yellow dashed line is our hypothesized location of the southern boundary of Alaska before the change in Pacific plate motion at 6 Ma. To view the figure's layers in the PDF version of this paper, open the PDF in Adobe Acrobat or Adobe Reader. To view the layers while reading the full-text version of the paper, click https://doi.org/10.1130/GES01488.I5 to download a PDF of the figure.

fault is allowed. Track C, in contrast, demands no convergence across the Fairweather fault. In that scenario, convergence would only occur north and east of the point where the Fairweather fault bifurcates east of Yakutat Bay (Fig. 2). Observations at the surface are not consistent with either of the end members of tracks A and C. There is strong geologic evidence for transpression along the Fairweather south of Yakutat Bay (e.g., Bruhn et al., 2004; Pavlis et al., 2004, McAleer et al., 2009); this evidence contradicts the predictions of track C. Track A is inconsistent with the GPS data, which define our track B in Figure 3. Track B is thus the only result consistent with the geologic data and the GPS data, which is why we illustrate only track B in Figure 13.

From a mantle perspective, the different models also have variable implications. If we assume rigid plate motion is defined by motion of the mantle lithosphere, track C requires ~10 mm/yr of mantle-lithosphere shortening perpendicular to Pacific plate motion, track B ~5 mm/yr, and track A requires none. We know of only two ways to accommodate convergence of mantle lithosphere: internal deformation of the mantle lithosphere, which would likely be focused at the boundaries, or bending of the entire plate. In the Appendix, we test the plate-bending hypothesis by computing shortening that could be accommodated solely by that mechanism. That analysis indicates that only 10–20 km of shortening could be accommodated by this mechanism alone without requiring the slab to be folded to a near vertical dip. That is roughly half the shortening required for track B but only about one-fourth of that required by track C. Hence, plate bending alone is probably not sufficient to take up the relative motion of track B in the mantle, let alone track C,