Fuston, S., and Wu, J., 2020, Raising the Resurrection plate from an unfolded-slab plate tectonic reconstruction of northwestern North America since early Cenozoic time: GSA Bulletin, <https://doi.org/10.1130/B35677.1>.

Supplemental Material

TABLE S1. UNFOLDED PRE-SUBDUCTION ALASKA AND CASCADIA SLAB LENGTHS

TABLE S2. COMPILATION OF PUBLISHED NEAR-TRENCH MAGMATIC SUITES AND SILEZTIA BASALTIC PLATEAU

Figure S1. Alaska slab spherical-Earth tomographic transects used in slab unfolding analysis. Black line denotes unfolded dVp contour. Tomographic models used for this analysis are: MITP16 (Burdick et al., 2017), MITP08 (Li et al., 2008), Gou19 (Gou et al., 2019), and UUP07 (Amaru, 2007). Transect locations are shown in Figure 3.

Figure S2. Cascadia slab spherical-Earth tomographic transects used in slab unfolding analysis. Black line denotes unfolded dVp contour. Tomographic models used for this analysis are: MITP16 (Burdick et al., 2017), MITP08 (Li et al., 2008), UUP07 (Amaru, 2007), S&L14 (Schmandt and Lin, 2014), Sig11 (Sigloch, 2011). Transect locations are shown in Figure 3.

Figure S3. Margin-parallel tomographic cross-section across the Alaska, Cascadia, and Yukon slabs. The top panel shows the tomography of Burdick et al. (2017) and bottom panel shows the tomography of Gou et al. (2019). In both tomographic models, the Yukon slab appears to be disconnected from the Alaska slab.

Figure S4. Plot in Figure 6 showing changes in Kula-Pacific and Farallon slab reconstructions from alternative global mantle reference frames. Distance along the margin illustrated (right). Reference frames used are: Torsvik et al. (2019); Torsvik et al. (2008); O'Neill et al. (2005).

Figure S5. Spatiotemporal comparison of our reconstructed Kula-Pacific and Farallon subduction histories along western North America (colored regions) relative to published and conceptual models. The present positions of near-trench magmatism are shown by hollow symbols, whereas grey filled symbols show near-trench magmatism restored with ~1200 km restored northward terrane translation. (a) “Small Resurrection” alternative plate model, characterized by a more southern location for the Kula-Resurrection ridge-trench intersection and a maximum of ~1200 km of northward terrane translation since 60 Ma (see “Small Resurrection” plate reconstruction video and GPlates files in supplemental materials). (b) Hypothetical “Mobilist” alternative interpretation (see Fig. 1A). The Small Resurrection plate model (a) fits within our tomographic constraints and is a permissible model. However, the “Mobilist” model (b) does not explain the northern reconstruction gap (upper white area) and is thus inconsistent with our constraints. Distance along the margin is illustrated in the map on the right.

Figure S6. Spatiotemporal comparison of our reconstructed Kula-Pacific and Farallon subduction histories along western North America (colored regions) to the published plate model of Madsen et al. (2006). Published near-trench magmatism (grey symbols) plotted as distance along the North American margin against time. The ridge-trench intersections presented in Madsen et al. (2006) shown by a solid red line largely fit within our reconstruction gaps (white areas) but crosscut our reconstructed oceanic lithosphere within certain areas (e.g., 2000 to 2500 km along the margin at 35 to 30 Ma). This implies that the more complex plate model of Madsen et al. (2006) is generally admissible within our constraints but may require refinements. Proposed ridge-trench intersections from this study shown by dashed black lines. Distance along the margin is illustrated in the map on the right.

REFERENCES CITED

- Amaru, M., 2007, Global Travel Time Tomography with 3-D Reference Models [Ph.D. Thesis]: Utrecht University, 174 p.
- Burdick, S., Vernon, F.L., Vladik, M., Eakins, J., Cox, T., Tytell, J., Mulder, T., White, M.C., Astiz, L., Pavlis, G.L., and van der Hilst, R.D., 2017, Model update May 2016: Upper-mantle heterogeneity beneath North America from travel-time tomography with global and USArray data: *Seismological Research Letters*, v. 88, no. 2A, p. 319–325, <https://doi.org/10.1785/0220160186>.
- Gou, T., Zhao, D., Huang, Z., and Wang, L., 2019, Aseismic Deep Slab and Mantle Flow Beneath Alaska: Insight From Anisotropic Tomography: *Journal of Geophysical Research. Solid Earth*, v. 124, no. 2, p. 1700–1724, <https://doi.org/10.1029/2018JB016639>.
- Li, C., van der Hilst, R.D., Engdahl, E.R., and Burdick, S., 2008, A new global model for P wave speed variations in Earth's mantle: *Geochemistry Geophysics Geosystems*, v. 9, no. 5, p. 353–357, <https://doi.org/10.1029/2007GC001806>.
- Madsen, J.K., Thorkelson, D.J., Friedman, R.M., and Marshall, D.D., 2006, Cenozoic to Recent plate configurations in the Pacific Basin: Ridge subduction and slab window magmatism in western North America: *Geosphere*, v. 2, no. 1, p. 11–34, <https://doi.org/10.1130/GES00020.1>.
- O'Neill, C., Müller, D., and Steinberger, B., 2005, On the uncertainties in hot spot reconstructions and the significance of moving hot spot reference frames: *Geochemistry Geophysics Geosystems*, v. 6, no. 4, p. 1–35, <https://doi.org/10.1029/2004GC000784>.
- Schmandt, B., and Lin, F.-C., 2014, P and S wave tomography of the mantle beneath the United States: *Geophysical Research Letters*, v. 41, no. 18, p. 6342–6349, <https://doi.org/10.1002/2014GL061231>.
- Sigloch, K., 2011, Mantle provinces under North America from multifrequency P wave tomography: *Geochemistry Geophysics Geosystems*, v. 12, no. 2, p. 1–27, <https://doi.org/10.1029/2010GC003421>.
- Torsvik, T.H., Müller, R.D., Van der Voo, R., Steinberger, B., and Gaina, C., 2008, Global plate motion frames: Toward a unified model: *Reviews of Geophysics*, v. 46, no. 3, p. 1–44, <https://doi.org/10.1029/2007RG000227>.
- Torsvik, T.H., Steinberger, B., Shephard, G.E., Doubrovine, P.V., Gaina, C., Domeier, M., Conrad, C.P., and Sager, W.W., 2019, Pacific-Panthalassic reconstructions: Overview, errata and the way forward: *Geochemistry Geophysics Geosystems*, v. 20, no. 7, p. 3659–3689, <https://doi.org/10.1029/2019GC008402>.

a) “Small Resurrection” End-Member (~1,200 km northward terrane translation)

b) “Mobilist” Model