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Mantle Displacement During Reactivation of Accreted Terranes in the New England Appalachians

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The Taconic thrust belt in New England is the type locality of the Ordovician Taconic orogeny, the result of partial subduction of the rifted Laurentian margin beneath the Gondwanan-derived Moretown terrane (MT) and the Shelburne Falls arc. Evidence for Ordovician deformation and metamorphism is only preserved in rocks of the Laurentian margin; Taconic deformation and metamorphism in the MT and suture zone were overprinted by Devonian Acadian tectonism. New thermochronological data from the Taconic thrust belt indicate that many faults were active during the Silurian and Devonian, well after the Taconic orogeny. Crust under accreted terranes in New England is much thinner (~30 km) than below the Grenville belt along the Laurentian margin (~45 km), and Li et al. (2018) noted a particularly abrupt change in crustal thickness in southwestern New England near the suture between Laurentia and the MT. New seismic evidence indicates that the abrupt offset in Moho depth in CT and MA occurs east of an anisotropic region (~25 km wide and ~15 km thick) that lies between the shallow Moho of the MT and the deep Moho of Laurentia. The Taconic and Acadian orogens are narrower in southern New England than they are to the north, suggesting greater crustal shortening, and high-grade metamorphic rocks exposed in southern New England indicate greater erosion of overlying crust. Hillenbrand et al. (2021) proposed that an Acadian plateau existed in southern New England from 380 to 330 Ma and that plateau collapse after 330 Ma led to the abrupt Moho offset. We suggest that an indenter in southern New England focused the Acadian collision between Laurentia and Avalonia leading to greater crustal shortening and uplift than elsewhere the Appalachians. The east-dipping suture zone and Neoproterozoic normal faults cutting the leading edge of Laurentia were reactivated as west-directed thrust faults. Further, the diffuse fault zone that displaced the MT and the leading edge of the Laurentian margin penetrated the crust and displaced the Moho beneath the MT creating a double Moho near the suture. The anisotropic zone between the double Moho region is likely composed of crustal and mantle rocks bounded by faults. It is unclear how far east rifted Grenville crust extends under the MT; it is possible that the MT is no longer above its original lithospheric mantle.

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