Assessing Whether Northeastern Earthquakes and Warm Springs are Produced by the Northern Appalachian Anomaly

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The passive margin of eastern North America has been tectonically quiescent for >100 Ma. However, earthquakes, mantle-derived ^{3}He in ground water and warm springs hint at continued activity. The recent proposal of asthenospheric upwelling (the Northern Appalachian Anomaly, NAA) beneath southern New England (SNE) raises the possibility that this activity is due to mantle melt. Its delivery to the lithosphere may lower density and cause stress, open pathways for ^{3}He, and heat the crust. We examine isostatic balance along the Levin et al. [2017] receiver function profile for which crustal thickness H and compressional-to-shear velocity ratio R are published. It crosses the continental margin north of the NAA and acts as a control against which regions closer to it may be compared. We use Christensen's [1996] measurements of rocks to predict crustal density Dc from R. Isostatic balance is estimated by combining H, Dc, elevation and mantle density Dm. We assume a constant Dm, which allows us to assess the imbalance due to factors other than mantle heterogeneities. The crust along the profile is *not* in isostatic balance, with very large disequilibrium pressure P (up to -33.6 MPa). We use the horizontal gradient of P as a proxy for crustal shear force and compare it to seismicity. The signals show significant correlation, indicating that both the isostatic imbalance and the crustal seismicity may be due to crustal features that are thought to be mostly "fossil"; that is, originating hundreds of millions of year ago when the crust was formed. While our results do not preclude the possibility that the present-day NAA is influencing isostatic disequilibria and seismicity in SNE, they indicate that distinguishing its effect from the very large ancient causes may be problematical. We also study warm springs underlain by the NAA and show that their temperatures have been stable over the last ~100 years, suggesting their importance in long-term heat transport.