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Lithospheric structure across the Trans-European Suture Zone in Eastern Carpathians from surface wave dispersion

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Cratons are preserved Precambrian continental remnants with anomalously high speed lithospheric roots as thick as 200 km. The extent of cratonic lithosphere beneath younger adjacent provinces and the way its edge is reworked during collision are uncertain. For example, the margin of the East European Craton (EEC), known as the TESZ (Trans-European Suture Zone) is well-defined in the northern parts of Europe, but it is obscured beneath the Carpathian orogen in Romania. Moroever, calc-alkaline volcanism associated with astenosphere upwelling and coeval sedimentary basins developed in hinterland of the Eastern Carpathians, beneath which the passive margin of the EEC is thought to have subducted. The Eastern Carathians are thus an ideal area to study cratonic margins in collisional settings with volcanic activity and the coeval development of extensonal basins.

To better understand how the lithospheric structure changes across the TESZ, from the Eastern European Craton to younger European microplates, across a young volcanic arc, we used earthquake data recorded at permanent broadband seismic stations from the Romanian National Seismic Network (RSN), not yet publicly available. Using the Multiple Filtering Technique (MFT), we analyzed Rayleigh and Love wave group velocity dispersion from earthquakes with epicentral distances less than 4000 km, with mb>4 recorded at RSN between 2010 and 2017. More than 4000 paths were integrated to construct group velocity maps between periods of 20 and 150 s, most sensitive to a depth range of 40-200 km.

This study provides the highest resolution surface wave images in an area not previously studied with broadband seismic dispersion techniques. We observe changes in lithopsheric seismic properties across the Carpathian Orogen and we correlate these anomalies with surface geology and previous studies of crustal structure and local tomography studies. Our results help better understand the structure of craton margins in colisional settings and to asses the impact of volcanic refertilization and basin formation in circumcratonic regions.