

## Abstract

Seismic data from 31 seismic stations, consisting of 16 SPREE (Superior Province Rifting Earthscope Experiment) and 15 TA (Transportable Array) instruments located from 80 - 97°W and 41 - 55°N were used to measure the lateral variation in the lithospheric fabric beneath the Superior Province and the Mid-Continent Rift (MCR). I made shear wave splitting measurements of SK(K)S phases by using the eigenvector minimization approach of Silver and Chan (1991). Error surfaces for multiple events were stacked in back-azimuthal swaths to examine directional variability. A single anisotropic layer model is sufficient to explain my data.

My results show a high split time in the western Superior Province (WSP), very weak splits in the Nipigon Embayment and a moderate split in the eastern Superior. I observed low split times in the Penokean, Yavapai and Matzagal Provinces. A region of very low split is newly detected by this study immediately to the east of Lake Superior. The MCR shows moderate to low split times. There are subtle variations in the direction of the fast shear wave across the study region. The fast directions align with the direction of the absolute plate motion and the direction of tectonic boundaries in most regions.

Lateral variation of anisotropy and lithospheric fabric is observed across the study area. The strong fabric observed in the western Superior is truncated to its east and to its south. I interpret southward truncation to be due to the Mid-Continent Rift. My result shows that lithospheric fabric in the Nipigon Embayment (NE) located just east of the WSP has been lost or seriously modified. The NE is interpreted to be an hotspot feature, which may have initiated the MCR. Moreover, the result of this study suggests that the lithosphere in the MCR may have been thinned or modified though not as much as the lithosphere of the NE. The newly discovered

localized low split zone northeast of the MCR is similar in split time and extent to the feature in the NE. The relatively weak split in the eastern Superior Province may possibly be attributed to partial loss or modification of preexisting fabric resulting from the Great Meteor hotspot track.