**Title:** Basin-scale characterization using teleseismic receiver function analysis

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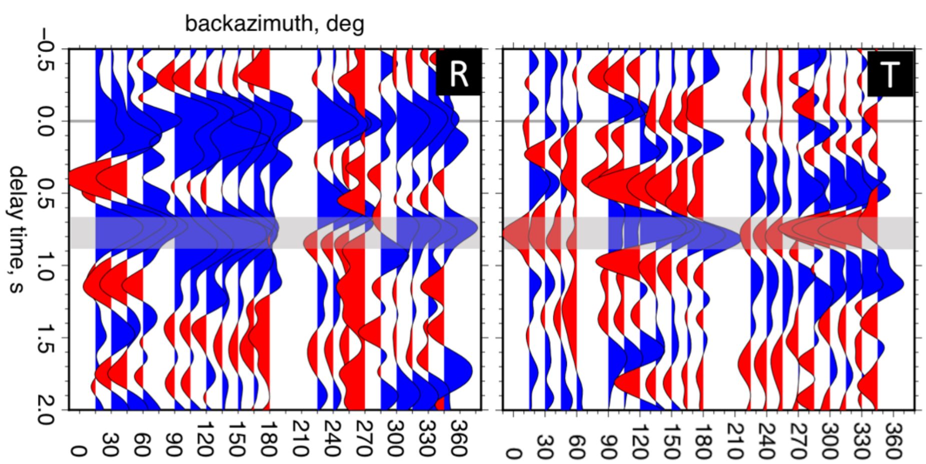
**Abstract text:**
Passive-source and controlled-source seismic surveys have traditionally targeted Earth structures of vastly different dimensions, with the former probing lithospheric (e.g., Moho) to whole-Earth structures, while the latter illuminating basin-scale geological structures. Although controlled-source surveys will likely remain as the standard method of seismic exploration for the shallow subsurface, their deployment is associated with high costs and complex logistics, as well as ethical and environmental concerns. With recent works demonstrating successful retrieval of salient basin structures using teleseisms or ambient noise, there has been a growing effort in the last decades to adapt passive-source techniques for non-invasive characterization of shallow subsurface, ultimately aimed for industry applications.

Among the existing passive-source observables, teleseismic mode-converted phases, such as P-to-S conversions in the P-coda, possess frequency contents that are high enough to resolve major lithological interfaces with strong impedance contrast. Conversions associated with basin-related impedance boundaries can thus be observed simply by incorporating higher frequencies in the standard receiver function (RF) methodologies. Here, we apply high-frequency RF analysis to broadband seismic data recorded at the LaBarge Passive Seismic Experiment (LPSE, Wyoming). In particular, we aim to characterize and interpret patterns of both lateral and azimuthal variations in signal amplitudes in the context of known regional geological structures.

In addition to observing sedimentary RF signals documented by the previous study (Leahy et al., 2012), we also find patterns of anisotropy-related directional variations in high frequency signals that can be interpreted as dipped sedimentary layers or aligned cracks. Furthermore, signal amplitudes show systematic lateral variation with respect to the position of fault along the seismic array. Finally, we also examine amplitude variations related to the angles of P-to-S incidence, analogous to the AVA (amplitude variation with angle) analysis routinely used in exploration seismology to infer lithological properties of a sedimentary layer.

**Image:**




An example of radial (R) and transverse (T) component back azimuthal RF gather computed at maximum frequency of 6 Hz, showing a signal from the sedimentary interval with 2-lobe anisotropic amplitude variation.