California State University
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The Department of Geological Sciences Presents:

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New measurements of seismic attenuation across the East African Rift support a model of rift-dominated melting

Tuesday, Nov. 1st, at **12:30 p.m.** in **LO1227**

Please call (818) 677-3541 or email geology@csun.edu if you have any questions

Abstract:

The asthenospheric mantle beneath the East African Rift (EAR) system has some of the slowest seismic velocities observed globally and is thought to host one or more mantle plumes. While the reduced velocities are thought to be partially the result of elevated temperature within the plume, comparative petrologic studies find that the thermal anomaly associated with the plume is relatively modest, suggesting that the presence of volatiles and/or melt is required to explain the total reduction in observed seismic wave speed. Critical in the comparative analysis of petrologic and seismic constraints is the proper quantification of seismic attenuation. However, large uncertainties in attenuation exist for the EAR.

To improve our understanding of the physical properties of the mantle beneath the EAR, we conducted an attenuation study of teleseismic P-wave phases recorded at broadband stations throughout east Africa. We calculated Δt^* for the region, which represents the integrated effect of attenuation over the entire raypath within the study area. From this work we find a maximum value (i.e., more attenuation) of 0.19 s beneath the southwestern Afar region and a minimum value (less attenuation) of -0.15 s beneath the Kaapvaal Craton, with intermediate values observed elsewhere. Assuming a two-layer system (lithosphere overlying highly attenuating asthenosphere) we conclude that thermal variations alone cannot account for the total reduction in seismic velocities beneath the EAR. To account for the remaining velocity reductions in this model, the presence of volatiles must be considered. Alternatively, we find that if a three-layer model is considered, where an enhanced highly attenuating layer is embedded within the asthenosphere, similar to melt-rich layers focused beneath spreading centers, we can replicate observed seismic velocity variations for cases where the enhanced attenuation layer is 40-110 km thick, without specifically invoking the presence of volatiles. Future work will focus on integrating our results with new and complimentary petrologic estimates and integrating additional seismic constraints to better determine the geometry of the high attenuation layer.