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## The Dynamic Lithosphere-asthenosphere Boundary: Results from the PI-LAB Experiment

The lithosphere-asthenosphere boundary (LAB) is an important aspect of plate tectonics that is not well-understood. Partial melt could weaken the mantle, and define the LAB, but the existence of persistent melt has remained controversial. Constraining the scale and pathways of the melt has proved challenging, and a wide range of scenarios have been reported. Ocean lithosphere is the simplest and perhaps the ideal location to study melt and its relationship to the LAB. We present new constraints on the LAB from the PI-LAB (Passive Imaging of the LAB) experiment at the equatorial Mid-Atlantic Ridge using a variety of seismic and magnetotelluric methods, with an emphasis on putting them in a broader global context. We find the LAB has a variable character depending on location: simple and with monotonic age progression, undulating, and underlain by a thin melt channel. Partial melt several hundred kilometers off the ridge axis is inferred, as is ridge-related transition zone thinning. Putting our result in the context of previous observations and melt interpretations suggests a wide variety of scenarios are possible both beneath oceans and continents. The implication is that melt persists over geologic timescales, although its character is dynamic. The result reconciles seemingly discrepant reports of melt in terms of geometry, location, pervasiveness, and volume from a variety of global studies. It suggests melt dynamics are important in driving plate tectonics and also to overall mantle convection. This suggests melt dynamics plays a larger role in controlling plate tectonics than previously thought.