Rock physics and seismic modeling of the Haynesville Shale

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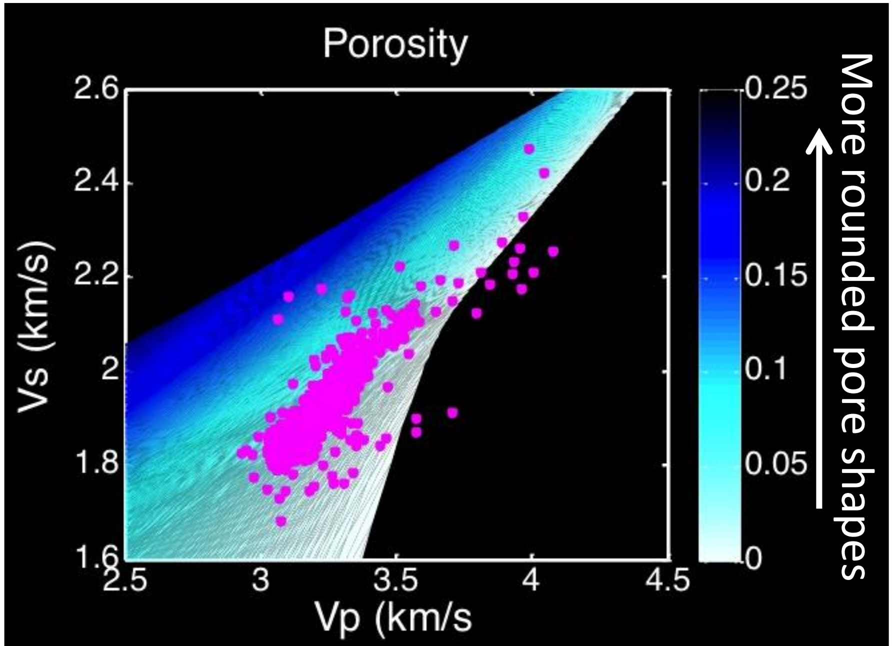
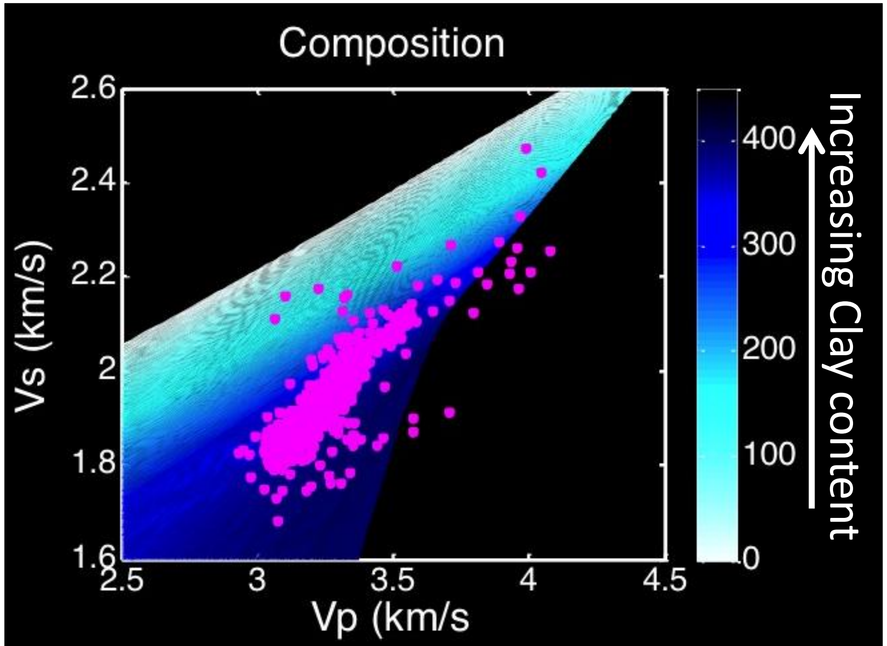


Shear (S) versus compressional (P) velocity. Shading corresponds to modeled porosity. Magenta points correspond to well-log velocity measurements within the Haynesville Shale. Porosity increases with darker colors as does the roundness of the modeled pore shapes.



Shear (S) versus compressional (P) velocity. Points are measured data, and the color is composition number. Mineralogic composition includes quartz, calcite, kerogen, and clay. For increasing composition numbers, the clay content increases while the quartz and calcite decreases.

A combination of directional-dependent compressional (P) and shear (S) wave velocities provide a way to explain the variations of porosity and composition in the Haynesville Shale. Within the anisotropic rock physics model, the porosity, pore shape, and composition are correlated, allowing elongated pores to be linked to high values of clay content. These parameters are important to model because the composition affects the brittleness of the rock, which increases as clay content decreases. Similarly, the pore shape affects the duration that the fractures would remain open. In particular, flat pores would lead to faster closing of induced fractures. Taken together, these factors control the productivity of any given well in the Haynesville Shale where an ideal well would reside in a zone with relatively low clay content and rounded pores. This rock physics modeling and analysis serves as the calibration point for performing seismic modeling and inversion to locate ideal zones for wells in the Haynesville Shale.