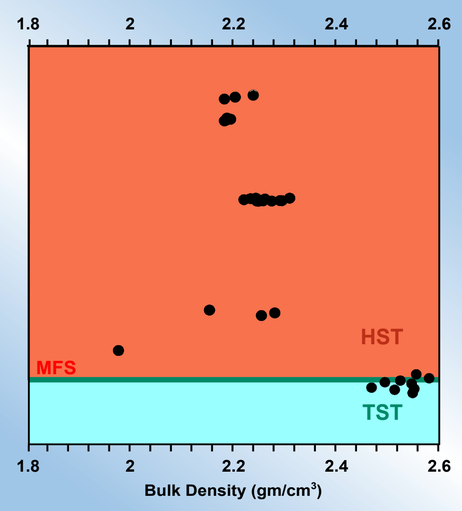
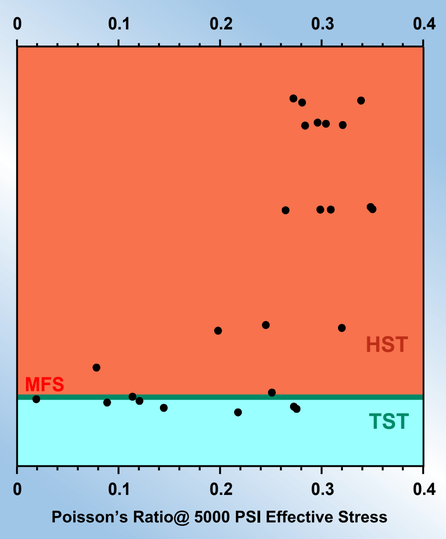
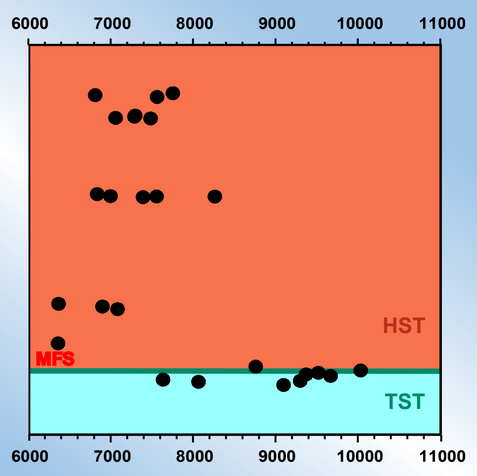
Seismic Model



Bulk density of TST shales greatly exceeds the bulk density of HST shales.

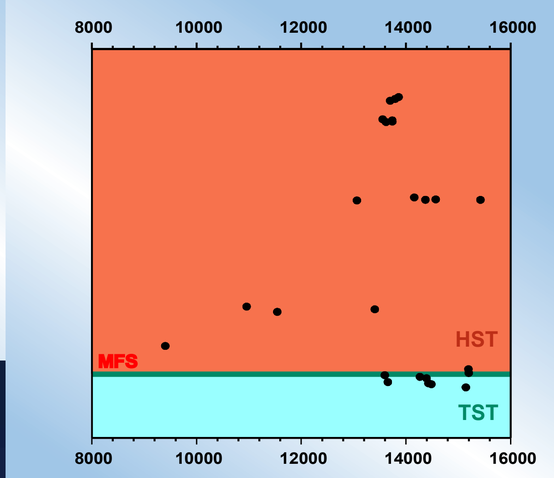


Poisson's ratio in TST shales is generally less than Poisson's ratio of HST shales.



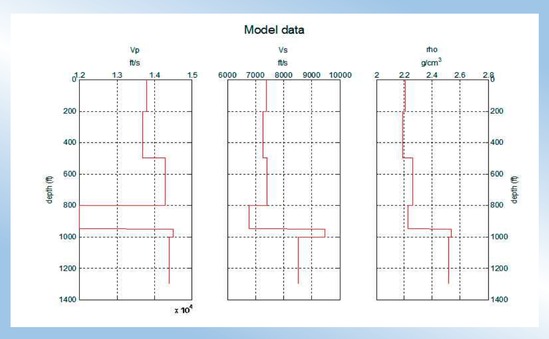
Shear velocity of TST shales exceeds the maximum shear velocity of HST shales.

Measurements reveal significant differences in the bulk density, Poisson's ratio, and shear velocity of TST and HST shales. The differences in rock properties across a shale-shale contact (i.e., low velocity and low density HST shale immediately above a high velocity and high density TST shale) could generate a strong seismic reflection.

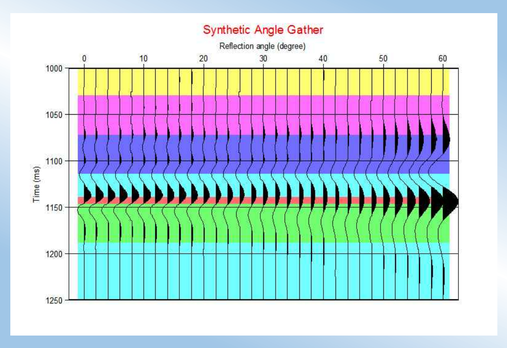


HST shales exhibit an overall increase in compressional velocity above the MFS. The average compressional velocity of TST shales is approximately equal to the maximum HST compressional velocity.

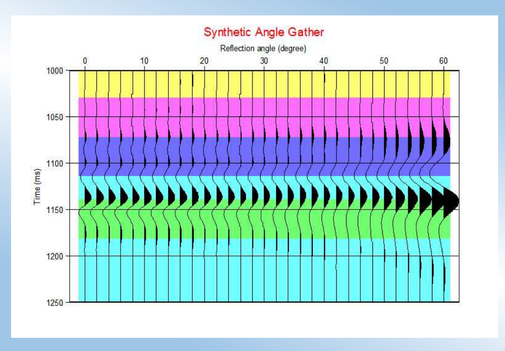
Data used for seismic model.



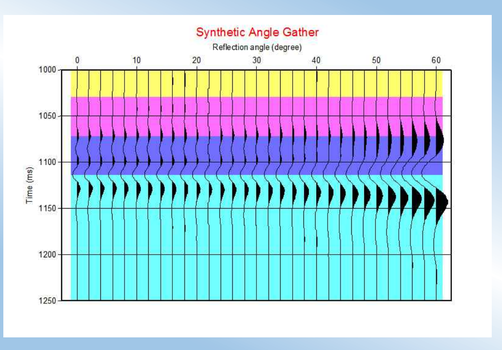
Model 1



Model 2



Model 3

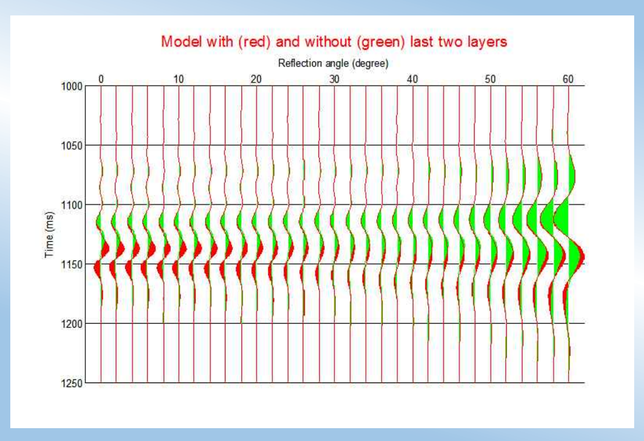


Shale Reflection Modeling Experiment

The basic modeling performed in this experiment used measured elastic rock properties data and layer thicknesses from well logs. Angle-specific reflection coefficients were computed for all interfaces and for angles ranging from 0 to 60 degrees. The result was an angle gather of reflection coefficients.

Each trace of this gather represents a specific reflection angle and was convolved with an angle-specific wavelet. These wavelets were derived from analog well data and stretched/squeezed to simulate the effect of NMO. The result is a synthetic seismic angle gather that shows the AVA effect of the gather (model 1).

To assess the effect of the thin high-impedance shale (orange layer) it was removed and the calculations repeated without it. The result (model 2) shows that the overall effect on the synthetic seismic is minimal. After removing both the orange and green layers (model 3), the effect is more noticeable but remains small.



This comparison of the seismic data from model 1 (red) and model 3 (green) shows the relatively minor effect of removing the orange and green layers.

This example shows a shale horizon (strong seismic reflector) that could be misinterpreted as hydrocarbon-saturated sandstone. Results from a well confirm the absence of sandstone.