Identifying Spikes in Sonic Slowness and in Resistivity in the Tuscaloosa Marine Shale Using Continuous Wavelet Transform

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ABSTRACT

The Tuscaloosa Marine Shale (TMS) is an unconventional play in central Louisiana and southwestern Mississippi. Based on studies of a limited number of cores from the TMS, other researchers have noted that the facies and the character of the porosity (pores as opposed to fractures) exhibit changes over small depth intervals (<1 ft); however, the changes in facies and porosity at that scale are often not discernible in the wireline logs. In this study, the continuous wavelet transform (CWT) technique was a means to identify small depth intervals over which abrupt changes in the response of geophysical well logs occurred as a means to highlight small depth intervals with changes in the character of the porosity.

Based on geophysical wireline logs of resistivity and sonic slowness, our work determined the depth intervals over which wavelet spectral power was high. These depth intervals correspond to depth intervals over which there are spikes (either positive or negative) in sonic slowness. Our interpretation is that the character of the porosity changes at these depth intervals; however, it is not clear if that change in character is from pores (background) to fractures (spikes) or if the change in character is due to the presence of thin sands (spikes) within the surrounding fractured shale (background). Nonetheless, our project highlights the usefulness of wavelet transforms as a means to discern changes in geophysical well logs over short depth intervals. In addition, these results highlight the heterogeneous nature of the porosity within the TMS and might be useful in reservoir characterization and well development efforts.

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