Application of Volumetric Seismic Attributes for Complex Fault Network Characterization on the North Slope, Alaska

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Abstract
Moxa Arch is a potential site for carbon sequestration in the state of Wyoming, recognized by the US Department of Energy. In this paper, we primarily focus on improving our understanding of the geology, including lithofacies and depositional environment, of Nugget Sandstone- a potential carbon storage reservoir, by integrating results from three different techniques including seismic attributes, seismic inversion, and petrophysical modeling. The Nugget Sandstone formation is primarily an eolian sandstone, deposited in the early Jurassic and is present throughout southwestern Wyoming. Seismic attribute analysis indicated the presence of NW-SE trending elongated geological features in the Nugget Sandstone interval. Based on our seismic and well log analyses, we interpret these features to be eolian sand dunes, which is consistent with the previous publications indicating a general NE-SW paleo-wind direction at the time of the deposition of Nugget Sandstone and other equivalent formations in Wyoming and Utah. The petrophysical analysis indicate that the Nugget Formation is mostly composed of quartz; however, clay and evaporites such as anhydrite and halite are also present. The acoustic impedance, derived from well logs indicate that high porosity dunal sandstones correspond to low impedance values whereas interdunal evaporites are characterized by high impedance values. Combined analysis of seismic attribute coherence and inverted P-impedance discriminates the dunal and interdunal deposits in 3D seismic data volume; the low coherence defines the extent of low impedance dunal deposits. Detailed analysis of the curvature attribute from the seismic data indicates a dominant paleo-wind direction of approximately N225o.