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The Impact of the Khuff Formation on the Unayzah Seismic Response; Central Saudi Arabia

The Permian age Unayzah Formation is a major hydrocarbon reservoir in Central Arabia. It is a complex multilateral and multistory unit of siltstone and variable quality sandstone. The Khuff Formation unconformably overlies the Unayzah. It is mainly carbonates with layers of evaporites. The basal Khuff consists of alternating layers of carbonates and shale grading upward into a uniform anhydrite layer. In some intervals, lateral heterogeneity is evident on well logs within the Khuff.

A new approach was developed to assess the lateral heterogeneity in the Khuff. It is basically a transformation of the well log properties from the depth domain to a pseudo geologic time domain (or depth in a reference well). It is a resampling technique applied to each stratal unit resulting in uniform samples in every well. This procedure removes variations implied by faulting (static correction), and the deposition rate (dynamic correction). It provides the basis to construct a rock-properties model in space and geologic time, and to produce statistical logs such as mean, variance and variation coefficients.

The variation coefficients (percentage standard deviation) logs clearly outline the heterogeneous intervals within the Khuff. The anhydrite and dolomite facies have greater lateral stability than the limestone, which grades into marls. Large variations are attributed to geologic anomalies such as channels. The position of these anomalies in depth relative to the reservoir, or key strong reflectors, is critical for seismic data processing and interpretation. Example slices from a 3-D seismic volume confirm these variations and show their impact on the Unayzah seismic signal.