Application of an Amplitude Seismic Attribute to Structural Framework Interpretation in the Rub' Al-Khali Basin, Saudi Arabia

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ABSTRACT

Historically, structural patterns and fault interpretation have been primarily identified using trace correlation seismic attributes such as Variance and Chaos, in combination with surface geometric attributes including dip azimuth and curvature. These are effective tools proven to be useful for structural analysis with seismic data. Effective use of the amplitude seismic data, when appropriately conditioned, may also constitute an effective tool for structural interpretation. In this work we will show the advantage of integrate the amplitude seismic attribute in structural interpretation.

The amplitude data hold much valuable information in order to interpret and generate Structural Framework analysis. For example, every diffraction point generate diminish in the amplitude value of a certain event. The amplitude data can be conditioned by a simple workflow introduced by Bulhoes and de Amorim (2005), and later developed by Araujo Dos Santos in his MSc Thesis (2010) and by Carrasco and Garcia (2014); this data conditioning was named as a TecVA Attribute. The principle of seismic layering assumes that seismic reflections (positive and negative) are meaningful and represent geological change between layers. The elemental seismic layer will be half the period of the wavelet; this is the weighting factor for this calculation. The first step in the workflow is to eliminate the negative values of the wavelet. The next step in this technique involves phase rotation through the Hilbert transform, simulating an improvement in the vertical resolution. This outcome achieves high contrast compared with the original amplitude data.

We will show three examples using amplitude data, all demonstrating improved understanding of the structural interpretation and predictability of the fault sealing capacity. In the first case, this methodology identified a fracture system in the interpreted top seal of one of the reservoirs in a field. This fracture system is interpreted to be responsible for leakage through this potential seal, resulting in an under-filled reservoir.

The second example shows the influence of deeper main faults on shallower units, producing a fault system that plays an important role in the diagenesis and fluid movement within this reservoir (as evidenced by enhanced dolomitization across this reservoir). Finally, the last example will show how this methodology helped define the tip line of the fault, a key point to determining the factors that control the hydrocarbon accumulation within this field.