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Combining rock physics simulation and Gaussian statistical technique to identify Fizz water and gas saturated reservoirs

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The variation in reflection amplitudes and seismic waves travel times can easily be inferred from seismic data and are very helpful to techniques to identify the hydrocarbons (oil/gas) bearing zones from non-hydrocarbons (water) facies [1]. However the differentiation of non-commercial gas (small amount of gas) from high gas saturation is one of important task in exploration geophysics [2]. Various techniques such as rock physics analysis [3], seismic inversion [4], amplitude versus offset analysis [5] etc. are in practice and used to discriminate fluids saturation and their types.

In the present study the impact of reservoir fluids (water, high and low gas saturations) on seismic and elastic parameters such as P and S wave velocities, their ratio, effective density, acoustic and elastic impedances, Poisson's ratio, bulk modulus, Lamé's constant, pore space modulus, fluids term etc. has been studied for Datta sandstone of Jurassic age, Lower Goru sand and Lumshiwal sands of Createceous age are widely distributed reservoirs in Upper Indus Basin, Lower Indus Basin and Kohat Basin respectively. The aim of this study is to analyse the relationship between pore fluids and their seismic and elastic properties to develop a set of attributes for these reservoir sands, which may further be helpful to identify the gas saturated facies.

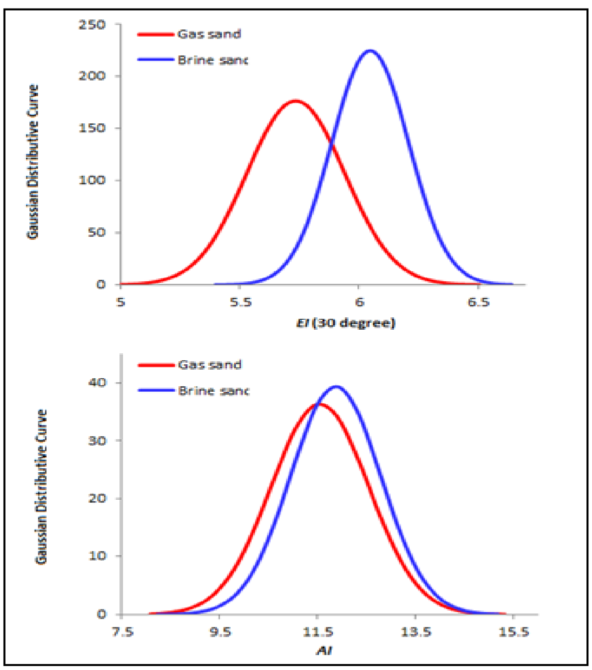

Figure 1: Gaussian distributive curves computed for elastic (EI) and (b) acoustic (AI) impedances when reservoir sand is fully saturated with gas and

First of all we have applied rock physics modelling by using Gassmann's [6] simulation and above described each attribute is computed as function of water, gas and fizz water saturated reservoirs. This simulation is performed for all three sand reservoirs of different geological ages.

To analyses the sensitivity to the pore fluids, Gaussian's distribution curves are plotted for different seismic and elastic parameters for 100 % and gas saturations. Our results reveal that offset dependent impedance (*EI*) is one of best seismic parameters to differentiate the low and high gas saturations from brine (Figure 1a), while in case of acoustic impedance (*AI*) strong overlapping exists between gas and brine saturated sand curves as shown in Figure 1b. Therefore, *EI* (30°) is one of best attributes work for all reservoirs.

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