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Carl Sondergeld[1], Chandra Rai[1] (1) University of Oklahoma, Tulsa, OK

Seismics, Rock Physics and Reservoirs

Historically the function of geophysicists has been to supply subsurface images or detailed estimates of parameters for reservoir description or risk reduction. These parameters often include porosity, permeability, fluid type, pressures, etc. However, seismic is incapable of measuring any of these parameters directly. Geophysicists measure travel times and amplitudes from which they compute velocities and other seismic parameters. The conversion of these observable parameters to those of petrophysical interest requires models, experimental data, and calibration. Hence, rock physics is often refered to as the missing link between seismic and resevoir petrophysics. Seismic rock physics seeks to understand the first order parametric influences on wave propagation which result from various petrophyscial signatures. The future requires the use of seismic in a more quantitative manner to determine variations in fracture density, intensity, or variations of shale volume, porosity or saturation. This can be achieved to some degree by applying the apropriate rock physics models for the geological environment. The models can be calibrated through laboratory studies and/or well logs at different scales. We face very real problems in addressing the limited sampling provided by each method in spatial and temporal frequencies. Additionally we face the challenge of reducing the cost of core characterization to make statistical sampling of geology reasonable. Sampling and scaling will remain a subject of intense interest in linking rock physics and reservoir characterization.