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by Dr. Joel Walls  
Rock Solid Images  
Houston, Texas

## Rock Physics, Well Logs and Reservoir Geophysics: Gulf Coast and Gulf of Mexico

Seismic reservoir characterization, also known as reservoir geophysics, has evolved over the past several years into a multi-disciplinary, business-critical function in most ED&P organizations. Sheriff defines reservoir geophysics as “The use of geophysical methods to assist in delineating or describing a reservoir or monitoring the changes in a reservoir as it is produced.” Reservoir geophysics is applied across a wide spectrum of the oilfield life cycle, from discovery and early development to tertiary recovery. One critical part of this process is careful analysis and understanding of petrophysical properties from well logs and core data (seismic petrophysics).

This presentation will illustrate why seismic petrophysics is so important and show how carefully constructed synthetic models can help the geoscientist interpret acoustic and elastic impedance inversion from seismic data.

Seismic petrophysics can be performed on single or multiple wells and consists of the following basic steps:

### Geophysical Well Log Analysis (GWLA)

- Collect and organize input data, reservoir conditions and fluid properties.
- Perform geophysical log interpretation for volume minerals, porosity and fluids over entire well.

- Edit logs and perform mud filtrate invasion correction (as needed).
- Generate missing curves (for example, shear-wave velocity).

*These models can improve interpretation of 3D seismic data, especially acoustic and elastic impedance inversion.*

### Rock Physics Modeling and Perturbations

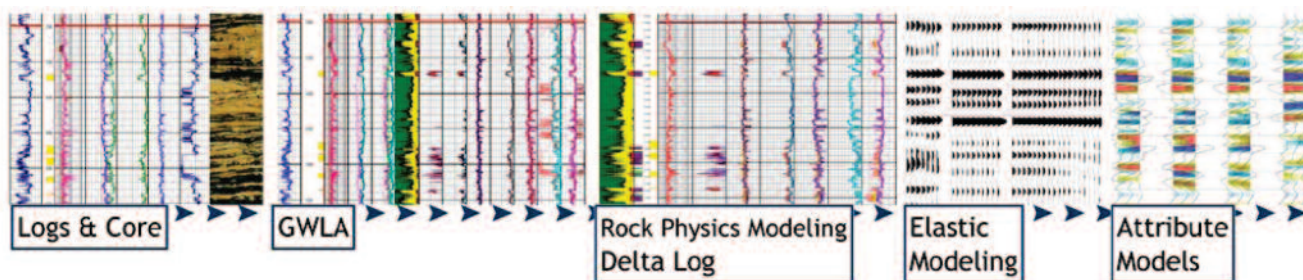
- Perturb reservoir properties using rock physics effective medium models and compute new  $V_p$ ,  $V_s$  and density curves to obtain fluid saturation, porosity, lithology and net/gross.

### Synthetics

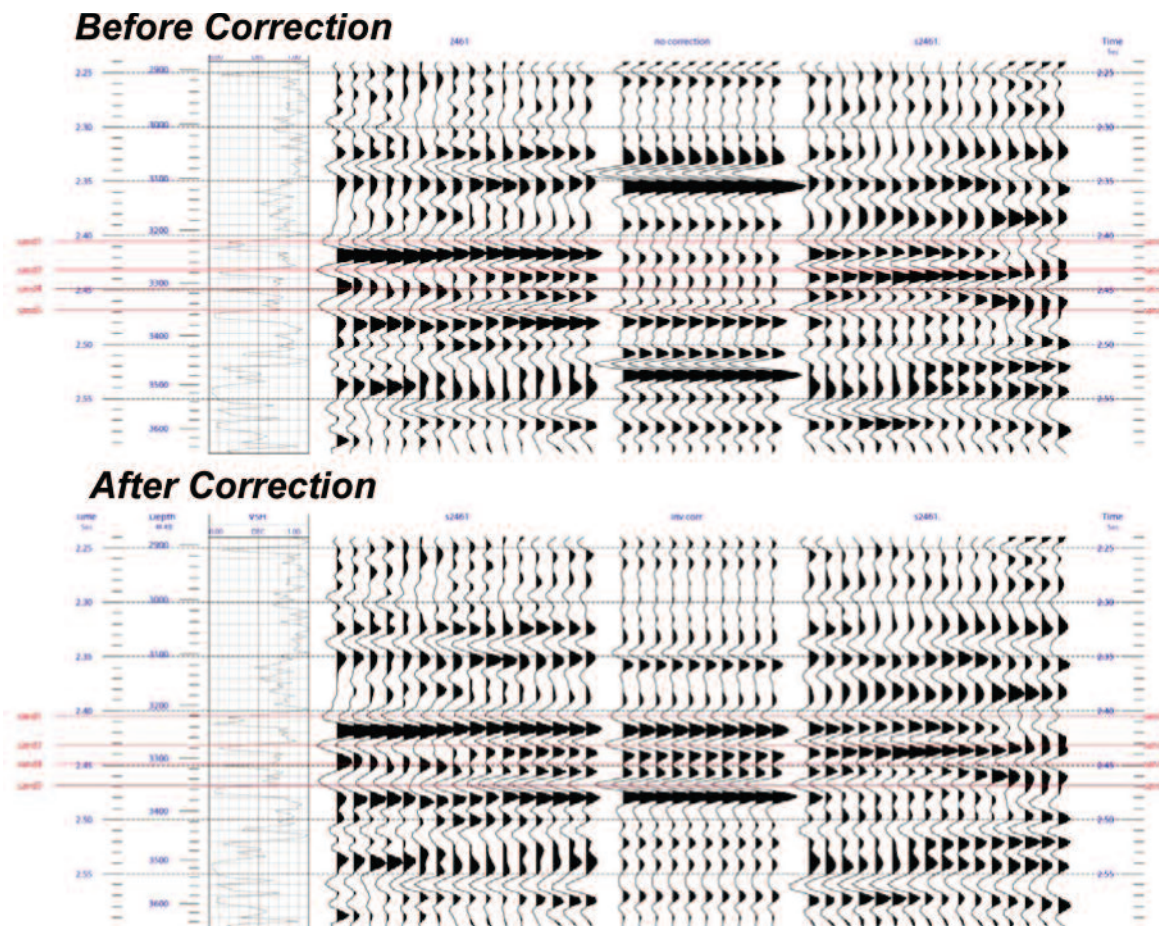
- Compute synthetic seismic traces for in-situ and modeled conditions.
- May also include: AVO response, acoustic impedance (AI) and elastic impedance (EI), and other seismic attributes as needed.

The primary benefits of seismic petrophysics are improved well-to-seismic ties, improved calibration of seismic attributes to reservoir properties and more reliable models of seismic response due to reservoir changes (vertically, laterally and temporally). These models can improve interpretation of 3D seismic data, especially acoustic and elastic impedance inversion. This improved interpretation can reduce drilling risk, enhance field productivity and ultimately increase asset value.

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Generalized seismic petrophysics workflow.



Stacked synthetics before and after corrections for mud filtrate invasion and wellbore washouts.

Examples show the effects of fluid saturation and porosity on seismic response in wells from the Texas and Louisiana Gulf Coast and the offshore GOM. Bad log data and mud filtrate invasion effects will also be discussed. ■

**Biographical Sketch**

JOEL WALLS obtained his PhD in geophysics from Stanford University in 1983. He has been active in research and technical services related to core analysis, rock physics and seismic reservoir characterization. Dr. Walls founded PetroSoft Inc. in 1992 to

bring rock physics technology to the desktop. Rock Solid Images (RSI) was founded in 1998 from the merger of PetroSoft Inc., Seismic Research Corp. and Discovery Bay. RSI has 35 employees in Houston, Oslo, Dubai and Kuala Lumpur. Dr. Walls is Vice President, Software Products.



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