Course Title: PRACTICAL SEISMIC PETROPHYSICS: THE EFFECTIVE USE OF LOG DATA FOR SEISMIC ANALYSIS

Summary

The conditioning and analysis of log data for quantitative seismic interpretation is often simply categorized as "rock physics." Unfortunately, rock physics workflows often overlook or oversimplify the proper editing and interpretation of log data, the result of which can be unrealistic expectations and interpretations of seismic amplitude responses. The more encompassing phrase "seismic petrophysics" better describes the necessary linkage between petrophysics and rock physics. Seismic petrophysics not only includes rock physics, but also includes the proper conditioning and interpretation of log data that should occur prior to the application of rock physics and seismic models. This is especially true in conditioning log data for shear-wave velocity estimation, fluid substitution calculations, and AVO modeling.

This class will focus on the important role of "seismic petrophysics" in the quest to extract additional information from subtle seismic responses. Some of the topics covered will include important background information, relevant aspects of petrophysical interpretation, various aspects of log editing, and the basics of elasticity and rock physics. We will spend considerable time discussing some common pitfalls associated with the "workhorses" of rock physics, including invasion corrections, problems associated with shear velocity estimation, and some of the challenges and pitfalls associated with Gassmann fluid substitution. It is important to recognize that log data should not simply be recomputed to fit prior expectations as defined by a rock physics model. Instead, rock physics models should be used as templates, which allow the interpreter to better understand the underlying physics of observed log responses and how they are governed by local petrophysical properties. Case studies will be used to reinforce critical concepts.

Duration and Training Method
This course consists of 3, one-half day virtual lectures, for a total of 12 hours.

Expectations

Participants should leave the class with good understanding of the fundamentals of rock physics and the critical role petrophysics plays in better understanding seismic responses. The instructor hopes that participants will leave the class enthusiastic about the role they can play in better understanding seismic data, as well as provide them with some of the basic knowledge and tools to speak the geophysical language.

Lab Exercises

There will be no exercises required as part of the class, but some problems and a spreadsheet will provided for those who would like to work on delve a bit deeper into some issues via hands-on exercises.

Who Should Attend?

Petrophysicists and geoscientists who are relatively new to rock physics and geophysics.

Prerequisites

A basic understanding of well logs and petrophysical interpretation

Anticipated Course Schedule

Day 1 (Tad Smith)

- Introduction
- The very basics of AVO
- Some fundamentals
- Velocity behavior in sedimentary rocks
- The Rock Frame
- Basics of anisotropy
- Log editing for seismic integration
- P-wave
- Density

Day 2 (Matt Blythe and Tad Smith)

- Fundamentals of sonic and density logs
- Shear velocity QC, estimation, and edits

Day 3

- Shear velocity QC, estimation, and editing
- Fluid substitutions and porosity modeling
- Special Topics (time permitting)
- Trend plots and cross-plots
- Managing and delivering seismic petrophysics for a QI project

Are handouts provided?

All class notes will be provided in PDF format

Course fees: Members $550, Non-members $650, Student $150 (activity enrolled in university)

Tad Smith specializes in seismic rock properties and petrophysics at Petrophysical Solutions, Inc (PSI). Prior to joining PSI in January of 2019, Tad worked as a technical contributor and/or manager at various companies, including Apache Corporation, ConocoPhillips, VeritasDGC, Newfield, BP, and Amoco. In 1995 – 1996, he participated in the Amoco Petrophysics Training program, where he developed a keen interest in petrophysics and seismic rock properties ("seismic petrophysics"). Since then, he has been actively engaged in the process of integrating petrophysical data into geophysical workflows. In 2011 he was the North American Honorary Lecturer for the Society of Exploration Geophysicists, with the topic of his tour being "Seismic Petrophysics". Tad was elected President of the Geophysical Society of Houston for the 2013-2014 term; he previously served as the GSH Secretary during the 2005-2006 term. From 2010 – 2014 he served on the editorial board for The Leading Edge, a leading industry publication, and served as the Editorial Board chair during the 2013-2014 term. He currently serves on the Board of Directors for the Society of Exploration Geophysicists as a Director at Large. Tad has a PhD in geology from Texas A&M University (1991), an MSc from Washington State University, and a BA from Ohio Wesleyan University. He is a member of SEG, SPWLA, and GSH. When he is not working on interesting petrophysical problems, he enjoys time with his wife and son, riding bicycles, spending time with good friends, and listening to good music.

Matthew Blyth, Schlumberger Drilling and Measurements will be providing the class with some very useful information on sonic and density logs.