2010 Fall SEG/AAPG Distinguished Lecturer

Rumblings from the Laboratory: Past, Present, and Future

Carl H. Sondergeld, *University of Oklahoma, Norman*

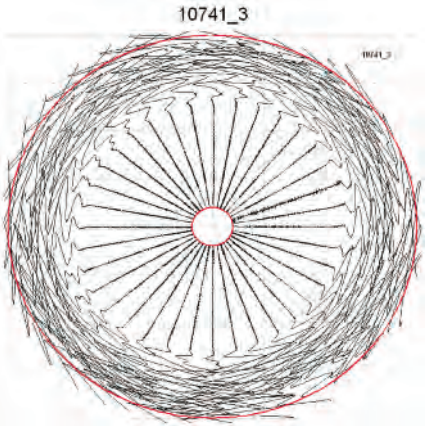
Supported by CGGVERITAS

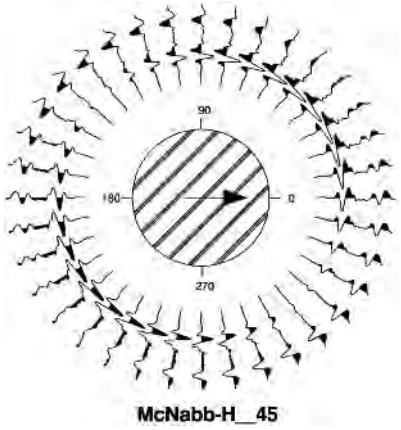
Thursday, December 9, 2010

Westchase Hilton • 9999 Westheimer • Social Hour 5:30–6:30 p.m. • Dinner 6:30–7:30 p.m.

Cost: $28 Preregistered members; $35 non-members & walk-ups. To guarantee a seat, you must pre-register on the HGS website and pre-pay with a credit card. Pre-registration without payment will not be accepted. You may still walk up and pay at the door, if extra seats are available.

The complexity of rocks in nature, and its resultant imprint on rock properties, makes empirical laboratory studies necessary and relevant. Numerous efforts are currently trying to use theoretical models to predict petrophysical and seismic rock properties from microscale images of rocks. However, modeling can only honor the physics of the chosen model; measurements are still needed to define and calibrate this physics. Historically, laboratory measurements have been used to develop an understanding of the physical response of rock and fluid systems under various conditions (frequency, temperature, stress, sample size, etc.). Early work was conducted to develop a better understanding of the correlations between compressional velocities, composition, density, porosity, and pore fluid type; this proved crucial to understanding sonic logs and seismic bright spots. The ability to measure shear and polarized shear velocities significantly expanded the applicability of rock physics to geophysical and engineering problems. Combining P and S-wave data, along with concepts of elasticity, provided the basis for lithology and fluid discrimination. Experimental confirmation of the Biot-Gassmann theory provided rock physics with one of the most important tools for the analysis of prestack seismic data.





New directions in rock physics research will extend the application by incorporating petrophysical characterization into our measurement. Concepts of capillarity and wettability are rarely incorporated into seismic modeling; however, both control fluid saturation and distribution. Promising future rock physics research include examination of the effects of pore microstructure on elasticity, examination of velocity behavior at temperatures and pressures equivalent to those found in deep basins, and the effects of CO_2 and time on seismic wave propagation through reservoir rocks. Simultaneous measurements of multiple properties will provide stronger modeling constraints. Application of new measurement and imaging technologies will allow us to extract more information from smaller and smaller samples, including samples from drill cuttings.

Our history is rich with examples of how laboratory measurements have lead to innovations in field-scale technologies. This

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talk will highlight past accomplishments in rock physics, and more importantly, will focus on future directions in rock physics and the promising and critical role of laboratory measurements in the development of new and innovative technologies.

Biographical Sketch

Carl H. Sondergeld is currently the Associate Dean of the Mewbourne College of Earth and Energy and the Curtis Mewbourne Professor at the Mewbourne School of Petroleum and Geological Engineering, University of Oklahoma. He earned a Ph.D. in geophysics from Cornell University and a B.A. and M.A. in geology from Queens College CUNY.

He spent 19 years at the Tulsa Research Center of Amoco Production Company where he conducted research in petro- and rock physics, taught courses internally and internationally in rock physics, AVO and pore pressure prediction, and helped develop rock properties and AVO forward modeling software, a comprehensive rock properties database, a mobile core characterization system (GEM), and an array sonic logging tool and processing system. He holds 14 US patents. For one year he worked with BP-Amoco mainly in technology transfer and as a technology advisor.

He has been at the University of Oklahoma for 10 years, primarily teaching petrophysics, geological well logging, and seismic reservoir modeling. He is the recipient of three departmental outstanding professor awards and the Brandon Griffith Engineering Professor Award. He has been instrumental in building world class research and undergraduate instructional facilities at OU.

He currently conducts research on unconventional reservoir rocks, in particular shales, and in the areas of microstructural characterization, anisotropy, NMR, petrophysics, hydraulic fracturing, and seismic reservoir modeling. He shares responsibilities for an industrial supported research consortium in "Experimental Rock Physics" and directing a multidisciplinary gas shale study. He is an active member of the SPE, SEG, serves as the Faculty Advisor to the OU SPE student chapter, and coaches the OU Petrobowl team.