Monday, March 26, 2007

HGS North American Explorationists Dinner Meeting

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

Cost: $28 Preregistered members; $35 non-members & walk-ups

The HGS prefers that you make your reservations on-line through the HGS website at www.hgs.org. If you have no Internet access, you can e-mail reservations@hgs.org, or call the office at 713-463-9476 (include your name, e-mail address, meeting you are attending, phone number and membership ID#).

by ***Bruce Hart***

3-Dimensional Seismic Imaging of Hydrothermal Dolomite Reservoirs

Hydrothermal dolomite reservoirs are receiving considerable attention lately because of successful exploration and development efforts in areas such as the Devonian of western Canada (e.g., Ladyfern Field) and the Ordovician Trenton–Black River (T-BR) play of the Appalachian Basin. We now recognize that the 500 million barrel Lima-Indiana and the 290 million barrel Albion-Scipio T-BR trends produce from hydrothermal dolomites. Recent T-BR gas discoveries in New York have had initial test rates of 3 to 42MMCFD (million cubic feet of gas per day). Furthermore, a hydrothermal dolomite component has been suggested for Ghawar Field,the world's largest oil field, North Field the world's largest gas field, and other large and small fields worldwide.

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In a structurally controlled hydrothermal dolomite reservoir, hot Mg-rich brines rise along fault and fracture networks to create porosity and dolomite in otherwise tight limestones. The hydrothermal origin is recognized by a variety of criteria, including the presence of saddle dolomite textures and geochemical data that indicate formation **North American** *continued on page 28*

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at elevated temperatures. Hydrothermal dolomite reservoirs are genetically related to Mississippi Valley–type ore deposits.

Hydrothermal dolomite prospects are commonly defined seismically, using a combination of criteria that includes sags on key horizons, fault geometry, changes in amplitude or frequency of the seismic data, and other observations. Drilling results based on these qualitative methods have been mixed and provide little insight into the controls on porosity and permeability development. In this presentation we use 2-D and 3-D seismic examples to examine some of the structural styles associated with productive T-BR reservoirs. We then show how quantitative seismic methods can be used to predict reservoir properties and improve our understanding of the relationships among faulting, fluid flow and reservoir development.

Two 3-D seismic-based projects from the T-BR play illustrate the methodology and results. We used well data to identify the stratigraphic and geographic variability of porosity development and to establish that porosity is developed only in dolomites. Wells were tied to seismic data via synthetic seismograms. Fault and fracture networks were mapped in coherence volumes. In one case faults define graben with a minor wrench component, whereas in the other study, the producing wells penetrate localized extensional collapse zones in a transpressive flower structure. We then integrated seismic attributes and log data to predict the distribution of porosity away from well locations. By merging the coherence-based faults with the porosity, we show that porosity is best developed in structural environments that combine extension and wrench faulting. ■

Biographical Sketch

Bruce Hart is an Associate Professor at McGill University. He held positions with the Geological Survey of Canada, Penn State and the New Mexico Bureau of Mines and Mineral Resources prior to joining McGill in 2000. His research interests focus on the integration of 3-D seismic data with other data types to characterize fractured reservoirs, heavy oil sands and other reservoirs. He was the Southwest Section AAPG's Educator of the Year in 2002–2003 and a visiting lecturer for the Canadian Society of Petroleum Geologists in 2006. He is currently (August 2006–May 2007) working as a seismic stratigrapher at ConocoPhillips in Houston while on sabbatical leave.