Monday, November 14, 2005

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

Cost: $25 Preregistered members; $30 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 **Steven H. Brachman***
Pogo Producing Company
Houston, Texas

Integration of 3D Seismic with Geological Knowledge Can Detect Non-Amplitude Combination Traps and Discover New Pay Zones in a 600-BCF Mature Play, Northern Lafourche Parish, Louisiana

Fifteen Middle and Lower Miocene reservoir sands have produced over 600 BCF equivalent from seven fields in the Thibodaux project area, northern Lafourche Parish, Louisiana (Figure 1). Traditional interpretations associated productive wells with classic Gulf Coast structural traps. On the basis of subsurface mapping, Pogo Producing Company's staff believed that opportunities existed for stratigraphic and combination traps in the Robulus L-age (Lower Miocene) sands and especially their uppermost member, the Nicholls Sand. Our team determined that an unconformity played a major role in determining the location of Nicholls production in the Thibodaux project area. Further mapping revealed other areas where potential for similar traps existed. Subsequent drilling by Pogo and its partners resulted in the largest Nicholls sand discovery to date.

Prior to the 3-D, we were unable to determine what trapped Nicholls Sand production and what caused variations in sand distribution.

Integrated Seismic and Geological Interpretation

The inability of 3-D seismic to help us identify the presence of either reservoir rock or hydrocarbon accumulations on the Thibodaux 3-D forced us to rely on our knowledge of the subsurface to help decipher **HGS General Dinner Meeting** *continued on page 19*

Figure 1: Location map of study area. Middle and Lower Miocene reservoir sands have produced over 600 BCFE from seven fields in the Thibodaux project area, northern Lafourche Parish, Louisiana.

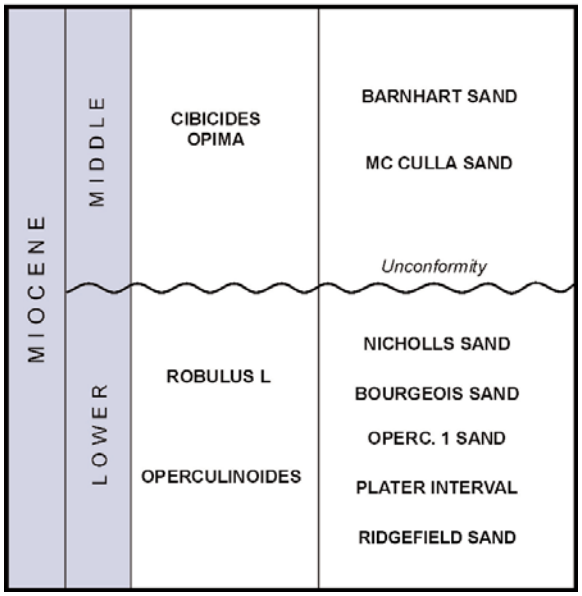

Figure 2: Thibodaux/Rousseau Southwest Lake Boeuf Area Stratigraphic column.

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geologic relationships in the upper Robulus L sequence. We answered the question of discontinuous Nicholls Sand distribution by identifying the correlation on seismic between a single strong amplitude event and Nicholls Lime, the subsurface relationship between Nicholls Lime and Nicholls Sand and the impact of the Middle/Lower Miocene unconformity. We concluded that careful subsurface mapping with available well control would give us a better opportunity to make new discoveries in the Thibodaux project area than we would obtain by relying only on 3-D seismic data.

In 1998, Pogo's staff undertook a study of the project area using over 400 well logs and four regional 2-D seismic lines. One result of our subsurface work was the verification of a regionally extensive erosional unconformity at the Middle Miocene/Lower Miocene boundary. Immediately underlying the unconformity is the overpressured Robulus L sequence (Figure 2). The Robulus L consists of up to five individual sands, each of which may be productive. The sands may show internal variation and changes in thickness, but the overall distribution of each unit is widespread, except for the Nicholls Sand. More than 37 BCFG and 1.5 MMBO have been produced from the Nicholls Sand in the project area. It is the uppermost member of the Robulus L sequence and its distribution is locally variable and unpredictable. Reservoir thickness may range from 10 ft to 90 ft. An overlying unit of much higher resistivity, referred to as Nicholls Lime, is found associated with the Nicholls Sand in about 90% of occurrences. Lithologically, the Nicholls Lime either is a calcareous clastic unit, a calcareous bentonite, a limestone or a chalky lime (Figure 3).

In 2000, Pogo and its partners, Dominion Resources, Pennington O&G and Anschutz Exploration, helped underwrite the 74 square mile Thibodaux 3-D seismic survey acquired by Seitel, Inc. This was planned to better define the complex geology of the project area, understand the nature of producing reservoirs and accurately

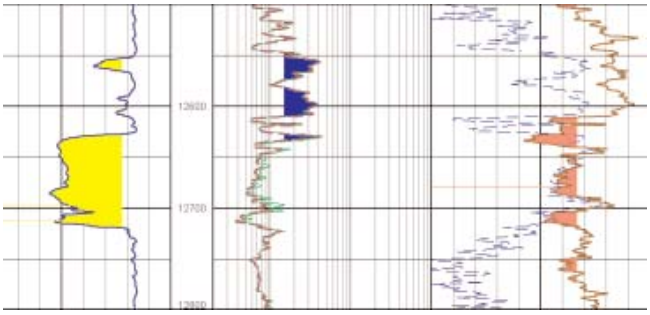

Figure 3: Well log of the Nicholls Sand (Robulus L). More than 37 BCFG and 1.5 MMBO have been produced from Nicholls Sand in the project area. The sand's distribution is locally variable and unpredictable.

locate untested conventional and unconventional traps. Prior to the 3-D, we were unable to determine what trapped Nicholls Sand production and what caused variations in sand distribution. Pogo and partners hoped to be able to isolate unique seismic attributes on the 3-D to help answer these questions.

Unfortunately, despite rigorous analysis of the 3-D data, the companies were not able to identify any seismic attributes associated with hydrocarbon-filled reservoirs or the presence/absence of sands in the overpressured section. Neither specially processed nor AVO volumes aided our effort. On the other hand, several continuous, highly positive amplitude events were observed in the 3-D volume. By incorporating subsurface information into the seismic data, we found that these highly positive events tied accurately to high-resistivity units throughout the Robulus L section, and they became our only lithology indicator. One particular amplitude event offered a reliable correlation with the Nicholls Lime. We mapped the high-amplitude event associated with the Nicholls Lime and used its positive correlation with the Nicholls Sand as an indirect indicator of reservoir. Areas where the event was absent were interpreted from subsurface and seismic evidence to have resulted from truncation by the Middle/Lower Miocene unconformity (Figure 4). ■

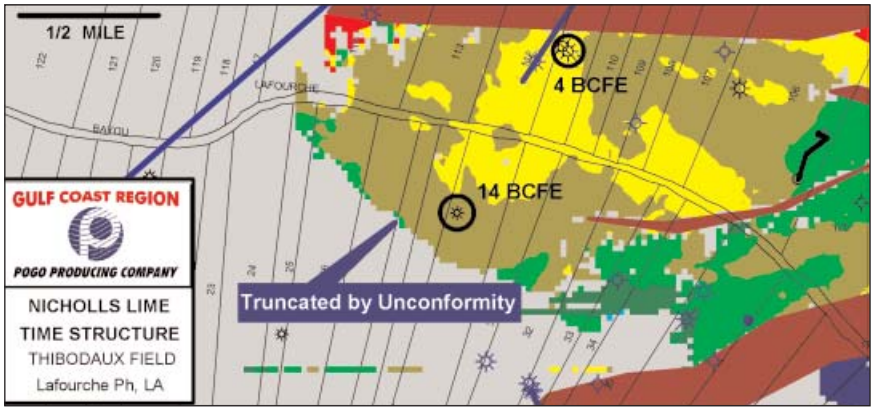

Figure 4: Time structure map on Nicholls Lime in Thibodaux Field. Note erosion of Nicholls facies to the southwest. Unconformity forms traps for Nicholls production in that portion of the field.

Acknowledgments

I would like to thank Pogo Producing Company for permission to publish this paper and Seitel, Inc. for permission to use its seismic data. I also thank our partners Dominion Resources, Pennington O&G and Anschutz Exploration for their technical input. This talk was scheduled for the 2005 GCAGS convention September 25, but the GCAGS convention was cancelled due to flooding in New Orleans.

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Biographical Sketch

Steven Brachman is division geologist for Pogo Producing Company. He is responsible for Pogo's activities in South Louisiana, including developing new exploration projects, evaluating third-party opportunities and supervising in-house prospect generation.

Steve has 24 years of experience, 18 in South Louisiana. He also has worked the mid-continent, Fort Worth basin, East Texas, Canada, offshore Gulf of Mexico and offshore California. Steve began his career in 1981 with Gulf Oil in Oklahoma City and was transferred to Kilgore, Texas, in 1983. He returned to Oklahoma City with SOHIO Petroleum in 1984 and was relocated to Houston the following year. Steve stayed with SOHIO/BP until 1990 and subsequently worked for Wintershall Energy, Araxas Exploration and Southwestern Energy and as an independent before joining Pogo in 1997.

Steve, a native of Chicago, Illinois, has a bachelor's degree in geology from Eastern Illinois University and a master's degree in geology from The Pennsylvania State University. He currently is president-elect of the HGS.