[PS]Characterizing the Lakota Sandstone Using 3-D Seismic Data and Well Data: Teapot Dome, Wyoming*

Brian J. Black[1], Tom C. Anderson[2], and Jane Ng[3]

Search and Discovery Article #40620 (2010)
Posted October 29, 2010

*Adapted from poster presentation at AAPG Annual Convention and Exhibition, New Orleans, Louisiana, April 11-14, 2010

[1]Navarro Research and Engineering, Rocky Mountain Oilfield Testing Center, Casper, WY (brian.black@rmotc.doe.gov)
[2]Navarro Research and Engineering, Rocky Mountain Oilfield Testing Center, Casper, WY
[3]Earth and Planetary Sciences, Harvard University, Boston, MA

Abstract

The Lower Cretaceous Lakota Sandstone is a conglomeratic sandstone that occurs on a regional scale throughout the Rocky Mountain province. The formation was deposited by fluvial systems transporting coarse-grained sediment east and north-east across broad alluvial plains. It has produced over 6,000,000 bbls of oil and 9.3 tcf of gas in the Powder River Basin in northeastern Wyoming. Since the opening of Naval Petroleum Reserve No. 3 to full production in the mid 1970's, over 194 MMCF of gas and 20,000 bbls of oil have been produced at Teapot Dome from the Lakota Sandstone. All of the production has come from the southern half of the field. In 2001, 3-D seismic data was acquired over Teapot Dome. This data shows an abrupt thickening of the Lakota Sandstone in the northern part of the field, which is confirmed with well data. In the southern two thirds of the field, the thickness of the Lakota Sandstone averages around 15 feet thick. The Lakota interval in northern third of the field averages around 45 feet in sand thickness and a few of the wells contain very thick deposits of over 70 feet of sand. Openhole log data show that these wells contain very good reservoir quality rock with average porosity around 16 percent. These thicker deposits however, are not laterally extensive and create distinct bullseyes on thickness maps. By co-rendering different seismic attributes together, and by creating stratal slices through the Lakota interval, some sinuous trends appear in the seismic data that otherwise are not apparent. Analyses of the seismic and well data show the sinuous trends coincide with the wells containing the anomalously thick Lakota sections. These features may represent meandering stream channels where the thickest sand deposits accumulated during deposition. Where penetrated, the thicker sandstones appear to be wet with minor oil and gas shows, but there may be further production possibilities higher on the Teapot Dome structure.

References

Chopra, S. and K. Marfurt, 2007, Seismic attributes for prospect identification and reservoir characterization: Tulsa, Society of Exploration Geophysicists, 464 p.

Hart, B., 2008, Channel detection in 3-D seismic data using sweetness: AAPG Bulletin, v. 92, p. 733-742.

Gustason, E. and T. Ryer, 1985, Stratigraphy and depositional history of Lakota and Cloverly Formations, Powder River Basin, Wyoming: ABSTRACT, AAPG Bulletin, v. 69, p. 850.

Muller, D. and J. Dobson, 1988, Lakota paleogeography and search for paleogeomorphically entrapped hydrocarbons—A second look: ABSTRACT, AAPG Bulletin, v. 72, p. 226.

Tomasso, M., R. Bouroullec, and D. Pyles, 2010, The use of spectral recomposition in tailored forward seismic modeling of outcrop analogs: AAPG Bulletin, v. 94, p. 457-474.

Websites

Laughlin, K., P. Garossino, and G. Patyka, 2003, Spectral decomposition for seismic stratigraphic patterns: Search and Discovery, article 40096, 4 p., Web accessed April 2010 http://www.searchanddiscovery.net/documents/geophysical/2003/laughlin/index.htm

United States Geological Survey, 2006, Assessment of undiscovered oil and gas resources of the Powder River Basin Province of Wyoming and Montana—2006 update, Fact Sheet 2006-3135, 2 p., Web accessed April 2010. http://egsc.usgs.gov/isb/pubs/ofrs/2006-1214/OFR2006-1214.pdf