



GeoNeurale

Northwest Florida Shelf exploration project

In 2007 BHP Billiton acquired a 2900 sq km leasehold in the northwest Florida shelf in water depths of about 1 to 1.25 km. This acquisition was based on interpretation of a 12,000 km 2D seismic dataset which had been processed through pre-stack depth migration; these data became available in 2006. They show a well developed 3500 m thick Jurassic to Cretaceous carbonate bank sequence draped over a broad basement high (basement appears to be composed of a mix of Precambrian crystalline and Paleozoic sedimentary rocks). Subsequent to acquisition of the leasehold, 9000 km of these data underwent an exhaustive depth reprocessing sequence which included 4 tomographic velocity updates. This project was overseen by Kevin Bishop and Tim Smith at BHP Billiton, and provided substantial uplift in overall seismic data quality, and confirmed the likely presence of a large (approximately 50,000 acre or 20,000 hectares) closure in the carbonate section draped over the basement high. Towards the conclusion of the 2D reprocessing project in early 2009, a large (about 19,000 sq km) 3D project was begun. This survey, which is in final processing, will provide combined regional and prospect level coverage. Both Bishop and Smith contributed to the acquisition and processing design of this survey, and have selected two final products, a pre-stack time product which will be used for stratigraphic analysis and seismic inversion, and a pre-stack depth product which will be used for overall structural interpretation. The pre-stack time product is due in January of 2010, and the pre-stack depth product is projected to be complete by March, 2010. Depending on interpretation results from the 3D, an exploration well is scheduled for the middle of 2011.

Seismic Interpretation in the Exploration Domain

This three day course provides a robust background in both the fundamentals and advanced aspects of 2D and 3D reflection seismic interpretation. It is divided into two essentially equal portions: the first consists primarily of lectures and associated exercises, and the second consists of 2D and 3D seismic interpretation projects designed to illustrate many of the concepts and techniques of seismic interpretation discussed in the lecture portion. The interpretation exercises use paper data because direct hands-on methods provide the best overall educational experience. They also avoid problems of non-familiarity with various software packages and licensing issues. The interpretation techniques which are demonstrated and employed in these exercises can later be effectively transposed to the workstation environment.

This course is primarily designed for explorationists/earth scientists who are advanced students, larger company personnel with 1 to 5 years of experience, and independent operators. The overall experience is directed towards optimization of seismic interpretation with regard to tightening budgets and increased expectations in the current hydrocarbon pricing environment.

Topics covered in the lecture portion include the following:

- The purposes and goals of seismic interpretation
- General concepts and concerns in seismic interpretation
- Description and sensitivity of seismically derived velocities
- Seismic migration: Time, Depth (Kirchoff, Wave, Beam Steer), Wide/Multi Azimuth. Particular reference is given to pre-stack depth migration.
- Vertical depth conversion of 2D and 3D time migrated data
- 2D vs. 3D seismic data interpretation techniques
- Grid guidelines and limitations in mapping
- Thin bed resolution and analysis
- Statics corrections for land data
- AVO and amplitude anomalies
- Generation and use of seismic inversions

The interpretation portion consists of two projects. The first consists of 8 2D lines from a complex structural region. This exercise involves tying these data with recognition of the limitations associated with the 2D format. The second consists of 15 lines from a 3D project covering the same region; some of the 3D lines overlie the 2D data and provide direct comparison between the two data sets. These data are used to prepare a structure contour map; and the exercise and course end with a discussion of this map and the overall set of processes used in effective seismic interpretation.

Timothy E. Smith

Biography

Dr. Timothy E. Smith (PhD, Ohio State University, 1976, paleomagnetism and plate tectonics) is currently a senior exploration geophysicist with BHP Billiton Petroleum in Houston, Texas. Prior to his current posting, he taught geophysics and structural geology at Eastern Kentucky and Ohio State Universities (1976-1977). He joined Gulf Oil in late 1977 and worked as an exploration geophysicist in several international assignments, including Tierra del Fuego, the Porcupine Seabight off Ireland, the Niger delta, offshore Brazil, Ras al Khaimah, the Red Sea, the Norwegian sector of the North Sea, and Gulf of Carpentaria, northern Australia. He left Gulf in 1984 to join Sohio/BP where he worked in the offshore Gulf of Mexico, and was directly involved with the Atlantis, Mad Dog, Shenzi, Neptune, and Thunder Horse discoveries which comprise over 1 billion bbl of recoverable oil. He left BP in 2003 to join Unocal and was involved with the Knotty Head discovery which may be over 250 million bbls of recoverable oil. He left Unocal in 2005 to join BHP Billiton where he currently is the lead geophysicist for a large block of acreage in the offshore northwest Florida shelf in which a well is scheduled in 2011. Since 1992, he has taught over 30 sessions and variations of the seismic interpretation course for the SEG, CSEG, AAPG, the University of Tulsa, and GeoNeurale.