

# Workshop on 'New and Emerging Technologies' at Mumbai

Compiled by Satinder Chopra

The Society of Petroleum Geophysicists (SPG), India, organized a workshop on 'New and Emerging Technologies', at Hotel Rang Sharda, Bandra (W), Mumbai on 5th November, 2006. In fact, SPG organizes such workshops occasionally at different venues within India and this happened to be one of them.

This workshop attracted over 150 participants, mostly from Oil and Natural Gas Corp. and Reliance Petroleum, Mumbai and some students from local universities.

Six talks were featured at the workshop. These talks were mostly delivered in an extended 45 minute format (except the last one which took 90 minutes) and focused on advancements in some of the areas of geophysics, keeping in line with the theme. The *first talk* entitled '*Prestack Depth Migration of time lapsed 3D-4C data over Valhall field*,' was delivered by Maz Farouki from PGS. In late 2003 BP and partners Shell, Total, and Amerada-Hess embarked on what can be described as the industry's ultimate seismic exercise – the repeat acquisition and processing of 4-component data over the Valhall field, offshore Norway, using a permanent sea-floor receiver installation. This 4D seismic exercise was designed specifically to monitor and manage the Valhall field; a baseline 3D survey and a series of six repeat monitor surveys were acquired and processed at 3-month intervals, in the world's first "Life of Field Seismic" or "LoFS" program. The case study discussed the processing issues and workflows used. The primary processing challenge involved imaging the reservoir in depth, in spite of a gas cloud, and required the development of velocity models for both the P-wave and the converted-wave data. Subsequent 4D processing to compare the baseline survey with the repeat monitor surveys aimed to capture true changes in the reservoir.

In the *second talk*, Iain Buchan, also from PGS, talked about '*Optical sensor and accelerometer revolution for seismic monitoring & acquisition*'. He said the fibre optic seismic sensor systems have been under development for many years at PGS and several generations of prototype seismic equipment have been produced to demonstrate the technology. Optical 4C seafloor cables have been successfully demonstrated during a number of field operations. The optical seismic technology is an excellent fit for conventional 4C seismic operations, and would also be the preferred solution for permanently installed reservoir monitoring systems. The dense wavelength division multiplexing (DWDM) technology used by PGS offers significant flexibility in terms of large dynamic range, the use of a very small number of optical fibres to record from several thousand channels, no in-sea electronics, light weight, reduced cost per channel, improved safety, and great reliability and durability.

The *third talk* was delivered by Manika Prasad from Indian Institute of Technology, Mumbai (on leave from CSM, Golden, Colorado). The talk was entitled '*Value of Rock Physics to the Indian Exploration Environment*'. Prasad promoted the

use of rock physics and showed its potential to the Indian scenario. Results were presented from work conducted during her stay at IIT Mumbai on: (a) developing site-specific depth trends – depth trends that will have relevance to specific Indian reservoirs have been built, (b) clay-shale systems – modern-day analogs from the Narmada River estuary were used to evaluate the seismic response, (c) properties of carbonate reservoirs, with applications to Bombay High field – fluid substitution might not always work in carbonate reservoirs and the assessment of sensitivity of seismic to monitor fluids was demonstrated. Finally, the applications of rock physics to reservoir monitoring of fluids and pressures, heavy oil exploration and discovery, and for deep-water prospects were showed.

The *fourth talk* was presented by Tim Brice from WesternGeco, Mumbai. His talk was entitled '*The simultaneous inversion of seismic data*,' wherein he described how seismic offset gathers hold information on density and two elastic parameters: compressional and shear velocities (or impedances) which may be recovered by inversion. He discussed one such method in which multiple offset stacks are simultaneously inverted to transform P-wave offset reflection data into these parameters. These, combined with well data, can be used to predict lithology, fluid and other rock properties such as Poisson's ratio and Lamé parameters.

The *fifth talk* entitled '*Practical 3D surface-related multiple prediction*' was delivered by Chris Koeninger. The shortcomings of 2D SRME primarily due to crossline structural dip and cable feathering were illustrated. A fast and efficient method of predicting timing errors and analyzing required crossline aperture between 2D and 3D SRME was tested on a real data example. This analysis could be used for survey design, during processing to optimize adaptive subtraction of predicted multiples and to determine when 3D SRME is necessary, and finally to QC the results and to locate problems in multiple prediction. In the final part of the talk the practical issues of 3D SRME relating to the under-sampled wavefield and the effect of azimuth on the predicted multiples were discussed.

The *last talk* of the day was delivered by Satinder Chopra from Arcis Corporation, Calgary on '*Seismic Attributes – a definite aid to seismic interpretation*.' Chopra demonstrated the application of curvature, coherence attributes as well as spectral decomposition and thin-bed reflectivity inversion to seismic data, for superior and accurate interpretation of such data. Using real data examples, he demonstrated how it could be challenging computing curvature attributes on horizons picked on 3D seismic data volumes, especially in datasets contaminated with noise and also in zones where the rock interfaces do not exhibit significant impedance contrast to warrant a pickable horizon. He showed examples of the use of volumetric computation of curvature, which dispels

Continued on Page 42

## Workshop on 'New and Emerging Technologies' at Mumbai

Continued from Page 41



Audience in attendance.

the need for horizon interpretation and provides valuable information on fracture orientation and density as well as mapping of other subsurface stratigraphic features. Next, different coherence attribute algorithms were discussed including their shortcomings. Applications on real data not only demonstrated the accurate interpretation of stratigraphic features and faults/fractures without any interpreter's bias, but the use of coherence as a QC tool in processing as well as the azimuthal coherence methodology for detecting subtle faults was also shown.

Chopra then went on to discuss the advantages of visualizing seismic data at discrete frequencies (within the frequency bandwidth of the data) that results in revealing anomalous or diagnostic behaviour not readily apparent on broadband seismic data. Finally, he showed examples of thin-bed reflectivity inversion



Tim Brice (WesternGeco) receiving SPG memento from I. B. Rao, President SPG Mumbai Chapter.

producing high-resolution reflectivity sections, which were far superior to conventional seismic sections, in terms of resolution and interpretability.

The workshop witnessed an optimistic feeling amongst the participants and many were seen chatting about the details of some of the talks delivered, during the tea/lunch breaks. Overall, SPG put up an excellent event that was well worth the time and effort of the attendees (who also received a generous leather folder along with a 1GB memory stick and a hand calculator). The insight and guidance of the SPG President and the professionalism and dedication with which the SPG volunteers organized this one day workshop is indeed commendable and so deserves our appreciation. **R**

# CALENDAR

2007			
<b>APRIL</b>			
1 - 4	<b>AAPG Annual Convention &amp; Exhibition</b>	Long Beach California, USA	<a href="http://www.aapg.org">www.aapg.org</a>
30 - May 3	<b>Offshore Technology Conference</b>	Houston Texas, USA	<a href="http://www.otcnet.org">www.otcnet.org</a>
<b>MAY</b>			
29 - June 1	<b>CGU Annual Meeting</b>	St. John's Newfoundland	<a href="http://www.cgu-ugc.ca">www.cgu-ugc.ca</a>
<b>JUNE</b>			
11 - 14	<b>EAGE 69th Annual Conference and Exhibition</b>	London England	<a href="http://www.eage.org">www.eage.org</a>
<b>SEPTEMBER</b>			
23 - 28	<b>SEG Int'l Exposition and 77th Annual Meeting</b>	San Antonio Texas, USA	<a href="http://meeting.seg.org">meeting.seg.org</a>