2009 Society of Exploration Geophysicists ★ Houston Preview

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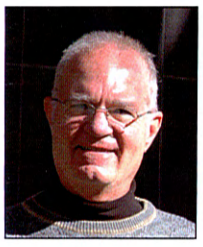
Hill – Smoothly Running SEG

Incoming president focused on organization's roots; sees areas of compromise and opportunity.

By Rhonda Duey, Senior Editor, *E&P*



Steve Hill

Each incoming SEG president has ideas for how to spend his or her tenure and must also consider how to maintain the initiatives that past presidents have established. And given the heady times that characterized the industry until 2008, those initiatives have been ambitious indeed.

But 2009 can not exactly be described as "heady times," and incoming SEG President Steve Hill is well aware of the fact that he's coming into his presidency at a time of uncertainty in the industry as well as in the global economy. So his plans for his presidency are not to institute vast new initiatives but, as he said, "to make sure all the parts work right."

"Probably the theme this year, almost by necessity, is going to be one of consolidation," Hill said. "Nothing grandiose, just making sure that we are in fact doing the kinds of things that we should be doing."

This requires getting back to the roots of the organization, and Hill said that in a recent meeting for the incoming executive committee it was determined that, in order to make good decisions on behalf of SEG, the committee had to have a common understanding of "what the SEG is about and what its principles are."

His suggested list of these principles includes the fact that SEG members are "geophysicists at the core. We're science-based. No question at all about that."

Secondly, the organization is global, with more than half of its membership now residing outside of the US and Canada. "The way I like to phrase it is that we're 'border-free,'" he said. "Our science doesn't see any borders, and hence what we do likewise does not see any borders."

Next, the society is member-driven, and the goal of the Executive Committee should be to focus on the sorts of activities that benefit all of the members. This committee governs SEG, and all other committees report to it, so it's a committee-based structure, with a staff on hand to help the membership accomplish its goals.

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SEG's 79th Annual Meeting Promises Innovation

Industry in the doldrums? Not this week!

By Linda Holeman, Associate Editor
THE LEADING EDGE

Geoscience professionals from across the globe will convene in the oil industry's epicenter as Houston hosts the 79th Annual Meeting of the Society of Exploration Geophysicists (SEG), Oct. 25-30, 2009.

Steve Emery, SEG's manager of meetings and conferences, said that advanced registration has been healthy, and the demand for booth space has been vigorous. SEG also expects an upsurge in attendance by its international members, who comprise 60% of the society's membership. This expectation is bolstered by the fact that 38% of attendees at last year's meeting in Las Vegas were from outside the US.

Industry-spanning innovation

SEG's annual meeting continues as the most valuable resource to the oil and gas, mining, environmental, and near-surface geophysical industries. Price volatility, climate concerns, and the geopolitical spectrum demand innovation, and the International Exhibition is where to find it. This year's exhibition will feature more than 300 companies from around the globe showcasing the latest in technology, research, and resources; many of these companies are start-ups exhibiting for the first time.

Student focus

SEG's student membership has seen explosive growth, and university and student programs are a key focus of

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An Opportunity to Learn about LF Seismic

Low-frequency passive seismic is proving to be a powerful tool with applications across the reservoir lifecycle.

Contributed by Spectraseis

The need to find and produce hydrocarbons from complex reservoirs in challenging environments is having a significant effect on exploration and development methods. There is a renewed focus on applying new technologies that increase the economic probability of success safely and in an environmentally friendly manner.

In the last three years, more than 30 low-frequency (LF) seismic jobs have been successfully completed for several major and national oil companies, demonstrating the applicability of LF in carbonates and sandstones for gas, oil, and heavy-oil reservoirs.

As experience grows, Spectraseis and its research partners continue to develop the technology, processing capabilities, and improved subsurface characterization. This is exemplified in the seven papers being presented by Spectraseis and its partners at SEG this year.

The technical papers cover a very wide technical spectrum, ranging from theoretical research to applied case studies, as can be seen below.

1. "Elastic time-reverse modeling imaging conditions." An examination of how Spectraseis, through its Time Reverse Modelling (TRM) algorithm, is using the elastic propagation, wave field decomposition, and correlation imaging (or migration) to image source locations and create a depth image of a hydrocarbon reservoir.
2. "Conceptual model of hydrocarbon reservoir related microtremors." The development of a rock physical model that proposes an explanation for the origin of hydrocarbon reservoir-related tremors found in LF seismic. The results indicate that the observed microtremor attributes above reservoirs are consistent with this preliminary model.
3. "Computational determination of effective properties of rocks using 3-D tomographic images." The generation of numerical estimations of the effective rock properties in the reservoir using a 3-D tomographic image.
4. "Using spectral attributes to detect seismic tremor sources – A synthetic study." A new method to detect subsurface seismic sources, where spectral attributes of the recorded seismic wavefield at low frequencies are used to map the surface projection of the sources.
5. "Frequency-dependent reflections from a layer with attenuation caused by interlayer flow." Attenuation, combined with tuning in layers, can generate reflection coefficients with significant amplitude and frequency dependence. The results can be applied to hydrocarbon reservoirs with high attenuation but low acoustic impedance contrast to the surrounding rock.
6. "Bayesian DHI using passive seismic low-frequency data." A statistical procedure for producing a Direct Hydrocarbon Indicator with LF data, derived from classical Bayesian methods. The approach utilizes LF attributes to map the probability of hydrocarbons in the subsurface.
7. "Extracting subsurface information from ambient seismic noise – An example from Germany." A case study of a job performed in Germany, demonstrating how human noise can be reduced or eliminated from LF data. Despite contamination of the records by anthropogenic noise, a statistically significant variation of the vertical over horizontal spectral amplitude (V/H ratio) was observed and used for subsurface characterization.

LF seismic technology detects variations of the seismic background wavefield (anomalies) believed to be generated by subsurface multiphase fluids in porous media – a situation typical of hydrocarbon-bearing reservoirs.

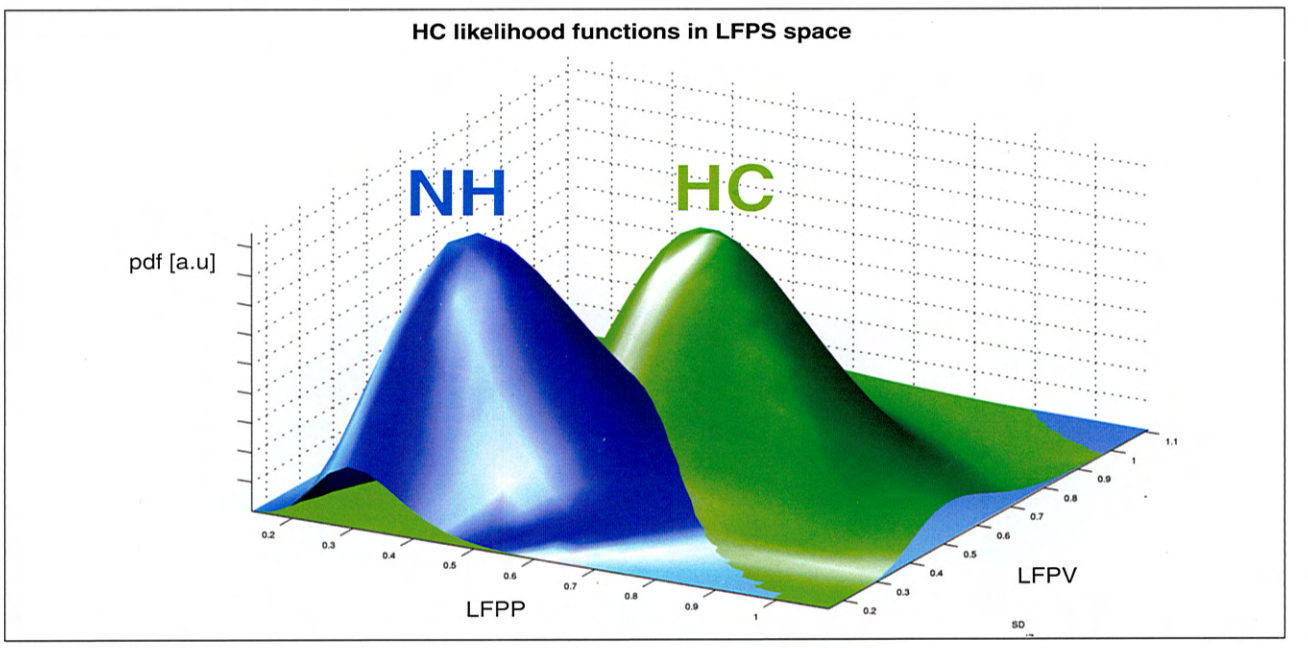
Spectraseis' broadband seismometer systems record and measure these anomalies. Noise from natural and anthropogenic sources is removed using proprietary processing systems prior to the data undergoing even more rigorous processing and analysis to identify potential hydrocarbon deposits.

The result is a direct hydrocarbon indicator at a fraction of the cost of reflection seismic coverage, which complements other field data and reduces the geological risks associated with traditional pre-drill data.

LF technology can improve the economics of exploration or development programs by mapping the probable hydrocarbon areas. As well as better well placement and production results, LF offers significant benefits from reduced health, safety, and environment exposure, including limited manpower requirements; cableless sensor packages; no environmental impact on surrounding communities; and no external sources, like vibroseis units or dynamite, which conventional seismic requires.

Spectraseis has taken a leadership role in the development of this technology. The result is commercially valuable subsurface information for exploration and field development decisions.

Visit the Spectraseis booth at SEG 2009 and attend the SEG technical program to find out how LF can help you. ■



Hydrocarbon probabilities: A low-frequency (LF) survey over a field in Texas was conducted to identify areas with increased prospectivity. As a first step, a small set of receivers, representative for hydrocarbon (HC) and non-hydrocarbon (NHC) areas, is selected. The attributes of these sets are used to construct HC and NHC Probability Density Functions (pdfs) over the 2-D space (shown in green and blue, respectively). In a probabilistic Bayesian approach, receivers in new areas are classified as HC or NHC by comparing their LF attributes with the constructed PDFs. ***(Image courtesy of Spectraseis)***

Geothermal Exploration Using AMT/MT and Gravity Techniques in Hungary

By Gang Yu, KMS Technologies – KJT Enterprises Inc.

Hungary is one of the most promising countries in Europe for utilization of low-temperature (< 150°C) geothermal energy because of its high thermal gradient, reaching almost 122° F/.6 mile (50° C/km) over most of the country. This high gradient is mainly caused by a relatively thin layer of the Earth's crust in that area and partly due to the non-permeable lower Pannonian sediment layer that covers a large part of the country. The main geothermal reservoir systems found in Hungary are the Mesozoic carbonate-karstic basement rocks and the Pliocene-Upper Pannonian porous sedimentary formations. KMS Technologies' geothermal evaluation project in Hungary has, since 2007, yielded possible well sites for geothermal energy production and utilization. The first drilled well was recently successful.

Hydrothermal exploration has traditionally used electromagnetic methods. The correlation between resistivity and temperature is associated with the local degree of hydrothermal alteration. Most high-temperature hydrothermal systems are indicated by a low resistivity layer over the geothermal reservoir that is caused by clay mineral alteration. Electrical methods provide information about rock properties, temperature, and the degree of hydrothermal alteration. This information can be used to determine the geometry of hydrothermal reservoirs, their depth, location of fracture zones, and the permeability distribution. To complement the electromagnetic method of choice (magnetotelluric or MT), gravity surveys were acquired along the MT survey lines with higher dense spacing to assist in detecting fault systems below the surface. Fault system information can be used to analyze and understand groundwater channels and water flow directions. At the same time, gravity data may be used to interpret the subsurface and to aid in locating prospective heat sources. Integrating the MT and gravity data reduces the ambiguity of either dataset and produces a more robust interpretation.

Hot geothermal water from the first geothermal evaluation well in Szentlörinc, Hungary. ***(Image courtesy of KMS Technologies – KJT Enterprises Inc.)***

Based on integrated processing and interpretation of electromagnetic, gravimetric, and seismic combined with stratigraphic information, the position of the first geothermal well site was selected in the Szentlörinc survey area.

In September 2009, the first geothermal well was successfully drilled using KMS exploration technology near the small town of Szentlörinc in South Hungary. Hot water with temperatures in excess of 185° F (85°C), estimated to have a peak heating capacity of 4 MW, was found at depths of 5,315 to 5,873 ft (1,620 to 1,790 m). This well will mainly produce from a crystalline basement from a fault zone approximately 5,577 to 5,774 ft (1,700 to 1,760 m) in depth. This discovery was possible due to the utilization of different geophysical and geological methods to determine the best well location.

An integrated approach that uses different datasets has proven to be a very effective method for locating the most promising areas for geothermal exploration. Utilizing this method in Hungary, with the goal of supplying 700,000 homes with geothermal energy within the next decade, is readily possible. Readers can visit our technical presentation at the SEG Workshop "Mining the Earth for heat and power: A soup-to-nuts overview of geothermal," Oct. 30, 2009. ■