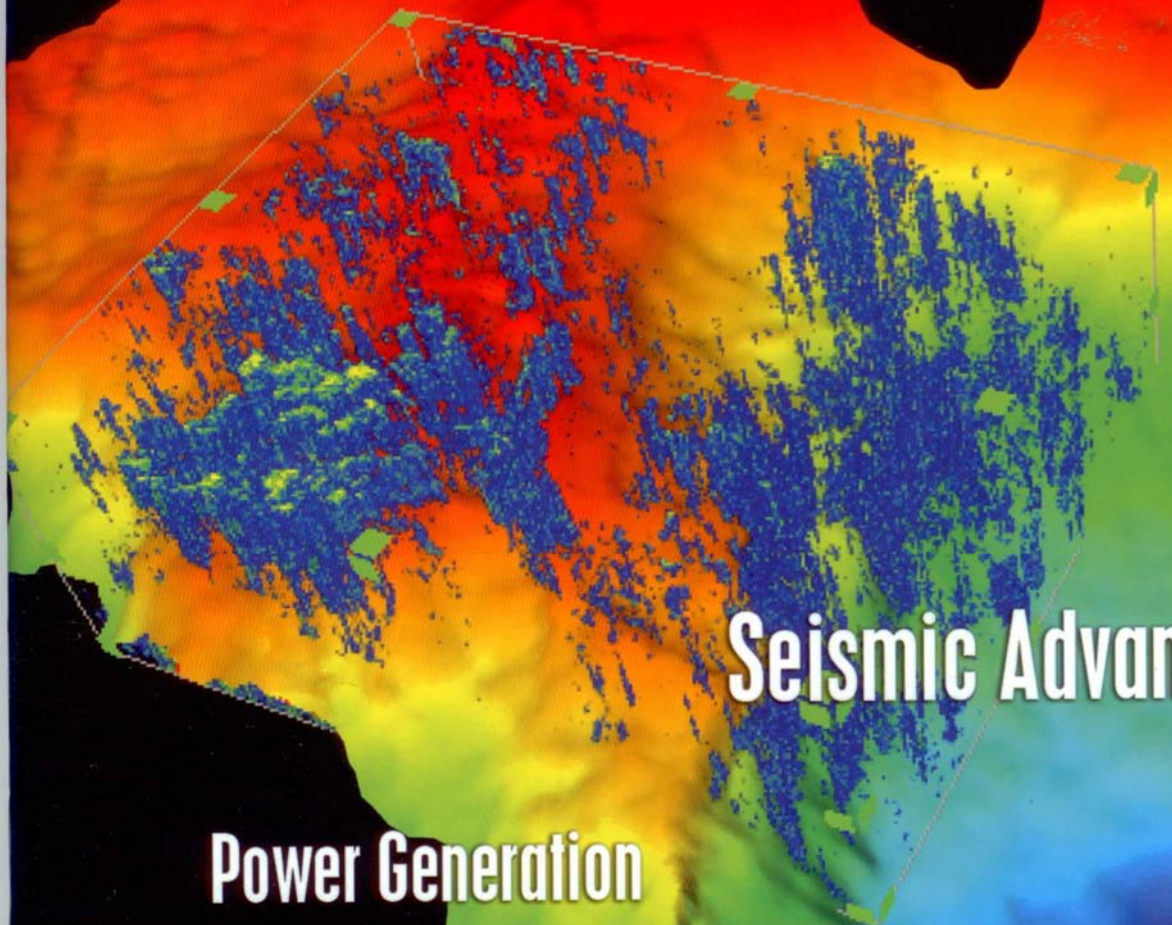
February 2011

Petroleum Africa

ISSN 1757-1383



Seismic Advancements

Power Generation at a Crossroads

African Focus

Unconventional Resources

Nigeria * Chad

www.petroleumafrica.com

By Jan Stellingwerff
dGB Earth Sciences

Meeting Africa's Seismic Interpretation Challenges

Today's seismic challenges are not just about the geology, but also about the human expertise required to address these challenges. Corporate investment into Africa's human resources is paying dividends on both sides of the equation.

Meeting the Seismic Challenge

With Africa a continent of vast oil and gas potential and with the geological challenges varying from country to country, seismic acquisition and interpretation technologies are on the increase throughout the continent.

Whether it be offshore seismic from the deepwater sedimentary basins of Angola, Gabon or Nigeria, through to the sparse 2D coverage of some of the less accessible, onshore areas in Libya, Algeria and Egypt, or the under-developed East African Rift System, extending from Lebanon in the north to Mozambique in the south, operators today are straining to generate greater value from the multiple volumes of seismic data they acquire.

However, while there's no doubt that seismic interpretation technologies have improved dramatically over the last few years in developing geologically consistent 3D representations of the African subsurface, too often operators are still left with highly general geological models that form an incomplete basis for crucial decisions on where to drill wells.

Furthermore, developing the technologies and then ensuring effective knowledge transfer so that experienced seismic interpreters as well as new entrants to the industry have the necessary skills to make the most of technology advances is another significant challenge as well.

That's why, through a combination of technology developments and partnerships with universities across Africa, dGB Earth Sciences are helping meet Africa's seismic interpretation challenges.

Increasing African Expertise

One of dGB's key goals is to increase the capabilities of the local African workforce to ensure that they are fully trained in the latest seismic interpretation capabilities. With the current global industry-wide shortage and the growth in national oil companies, the onus is on capacity building at a local level.

Anthony Lobo, Partner, KPMG in the UK and head of the UK's Oil and Gas practice puts it well when he says: "The rapid growth of the National Oil Company sector has outstripped the availability of employees in many parts of the world, and it is now a real risk to the future of some of these companies as they and their contractors struggle to meet demand and deal with the issues created by a workforce approaching retirement age."

In order to develop the next generation of African graduates, it's essential that effective knowledge transfer is established between the commercial oil and gas sector and university students and graduates, with the adoption of seismic interpretation skills particularly important.

The growing focus African governments are placing on 'local content' in upstream exploration and production is also another key driver for this. In Nigeria, for example, the National Petroleum Investment Management Services (NAPIMS) is playing a key role in promoting the use of local resources in areas such as seismic data processing, front end engineering and design work, and management positions.

So how are we establishing effective knowledge transfer in Africa?

With the whole premise of our seismic interpretation OpendTect software being based around openness and collaboration, dGB has been making the free software and many of its commercial plug-ins available to universities throughout the world.

There are two twin goals to this – to bring graduates and future entrants into the oil and gas industry up to speed with the latest seismic interpretation techniques and to also use these universities as test groups as we look to further develop the software.

Since September 2009 OpendTect has been downloaded over 40,000 times direct from the dGB web site. dGB have also dispensed over 1,500 free licenses to 200 universities worldwide – a truly global list which includes 58 universities in Europe, 12 in the Middle East, 28 in Asia, 10 in the Asia Pacific region, 43 in the Americas, and, most relevant to this article, 27 in Africa.

African universities that have benefitted include Ain Shams University and Al Azahar University in Cairo, Egypt; Al Neelain University and

the University of Dongola in Sudan; the University of Boumerdes in Algeria; and the University of Ghana near Accra.

Last June, in partnership with local Nigerian oil and gas services provider Danvic Concepts International, dGB donated $4.8 million of software to 20 Nigerian universities. These included Ahmada Bello University in Zaria; Covenant University and Crawford University, both in Ogun State; the Federal Universities of Technology in Akura and Owerri; Kogi State University; Niger Delta University; the University of Lagos; and the Rivers State University of Science & Technology in Port Harcourt. *Figure 1* shows a training seminar taking place in Lagos (*Paul de Groot, CEO of dGB picture on right*).

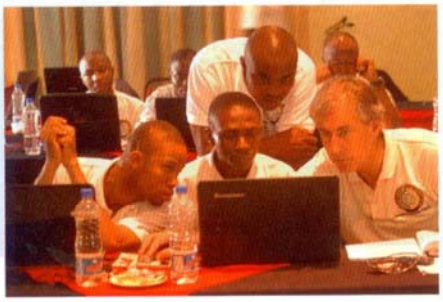


Figure 1

One example of recent feedback came from Obafemi Awolowo University in Osun State, Nigeria, where Dr. Adepelumi Adekunle Abraham, Senior Lecturer in Geophysics, said: "Since the installation of OpendTect in our University, the quality of our teaching and research has significantly improved. We now have several students using one aspect or the other of the OpendTect for their projects (BSc, MSc and PhD)."

In addition to this, dGB has also built up a database of seismic information for African universities to work with. dGB's Open Seismic Repository contains seismic data, interpreted horizons and well data from a number of global locations including Central Alaska, offshore Netherlands, and the North Atlantic Ocean, offshore Canada. In this way, students are not only able to access one of the industry's leading seismic interpretation packages and many of its commercial applications, but also have up-to-date seismic data to work with.

African Expertise

dGB Earth Sciences also has significant expertise in Africa to draw upon.

For example, dGB Earth Sciences recently conducted a survey in a deepwater concession offshore Cote D'Ivoire. The goal of the survey was to track fluid migration which can reveal vital information on hydrocarbon migration paths and the overall petroleum system. A key means of doing this is through chimney cubes – vertical noise trials which are generated when fluids from deep thermally mature source rocks migrate upwards.

In the Cote D'Ivoire survey, suspected gas chimneys were observed in the seismic data above the potential prospects. The results found that the chimneys originated from a suspected Lower Cretaceous source rock interval and, *as figure 2* demonstrates, dGB's software was able to generate a 3D View of the Gas Chimneys.

dGB are also keen to share experiences in Africa of OpendTect's new abilities to increase the density of tracked horizons.

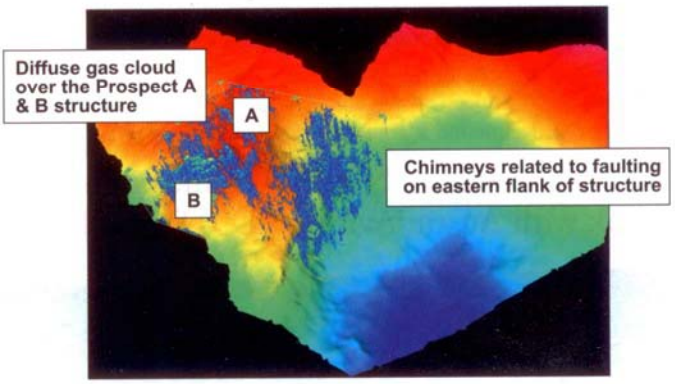


Figure 2

Increasing both the number and density of tracked horizons in the seismic interpretation process can lead to more accurate and more detailed geologic models. To this end, dGB Earth Sciences has recently developed an advanced algorithm able to calculate hundreds of horizons throughout a 3D volume.

The result for African operators is improved quantitative rock property estimation and stratigraphic traps definition, more accurate and robust geological models, and the ability for interpreters to extract more from their high resolution seismic data.

The Importance of an Accessible, Intuitive Workflow

A final key driver to the future of seismic interpretation is making the workflow processes more accessible and intuitive, and moving away from a focus on manually-dominated processes. In this way, seismic interpreters can be more productive and the software can be accessible across the asset team.

It is with this in mind that dGB Earth Sciences has teamed up with Japanese company Wacom, the world's leading manufacturer of pen tablets, interactive pen displays, and digital interface solutions. The new partnership combines Wacom's expertise in the graphics sector with OpendTect and in particular, our new advances in mapping horizons.

Through Wacom's interactive pen display technology, seismic interpreters can interact directly with the tablet in their editing and visualization activities. Faults can also be simply drawn into the data set and different attributes can be applied to the workflow and if a horizon goes awry, the interpreter can go in and edit it and add channels that have been missed.

For African seismic interpreters, the result is a highly user-friendly and graphics-focused environment that can only help to increase seismic interpretation skills within Africa.

As the pressures grow on African oil companies to maximize exploration efforts from increasingly complex reserves, the demand for technical expertise is only likely to increase. dGB looks forward to working with many universities and 'would be' seismic interpreters throughout Africa over the coming years to ensure that this momentum continues.

By Guy Brown
Technical Correspondent

Open To Interpretation

dGB has taken a bold step in offering a truly open source seismic interpretation base system. Petroleum Africa spoke to Paul de Groot, CEO of dGB Earth Sciences on the groundbreaking OpendTect system.

dGB has adopted the Open Source business model for its flagship seismic interpretation software: OpendTect. The Open Source base system, which is not protected by any licensing software, can be extended at run-time with commercial (closed-source) plug-ins. This model promises to change the seismic interpretation landscape. It gives all potential users access to advanced seismic interpretation techniques. As open source, the model can stimulate research and shorten product development times. Paul de Groot, CEO of dGB Earth Sciences reveals some of the thinking behind OpendTect.

PA: When was DGB's open source base system OpendTect first made available?
De Groot: OpendTect first became available in 2003. It was in 2009, however, that we adopted the General Public License (GPL) and became truly open source. Since September 1, 2009 OpendTect has been downloaded over 40,000 times direct from our web site.

PA: What were some of the drivers behind OpendTect's conception?
De Groot: We wanted to create a truly open platform for seismic interpretation. While seismic interpretation software has advanced considerably over the last few years, the industry still suffered from a lack of integration between different applications and a lack of input from users.

Technology advances were also being blocked, to a certain extent, through a system that was monopolized by just a few players. If you wanted to launch a new technology, you had to build a complete interpretation system as well. In other words, vendors spent 99% of their time on building an environment and only 1% on creating new software.

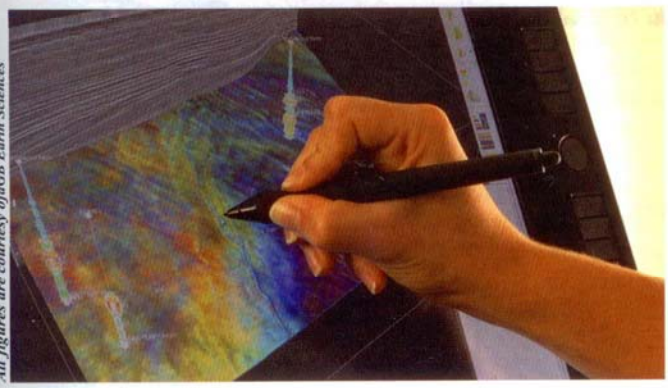
We had created such an environment and decided to share that with others. We also wanted to shorten the gap between academic research and operational deployment, and enable geo-scientists in the industry, who had bright ideas, to deploy their ideas in a professional environment, such as OpendTect.

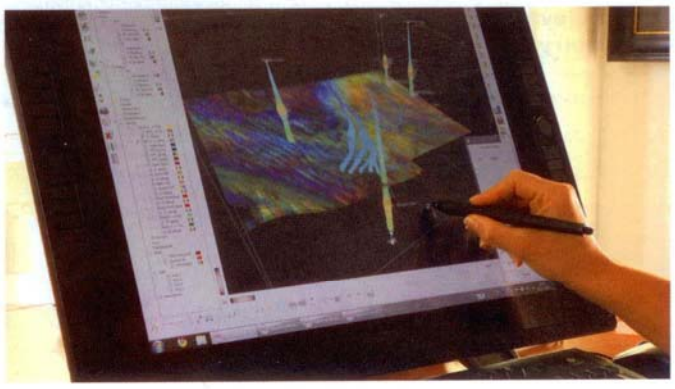
PA: In what ways is this technology helping to foster collaboration between seismic software vendors? What are some of the benefits of increased collaboration?
De Groot: It's helping foster collaboration because it's open and it really does provide highly sophisticated seismic interpretation tools (some prospective users ask: what's the catch? The answer is there isn't one).

It also facilitates collaboration between software vendors as it provides the ideal platform for developing and designing additional tools. To this end, some oilfield services companies have taken the open source code of OpendTect and developed their own commercial plugins – something we actively encourage.

For example, UK-based seismic geophysics specialists, ARKCLS have developed a seismic spectral blueing and seismic colored inversion plugins for our software as well as a workstation access plugin which supports direct import and export from Landmark's SeisWorks/OpenWorks and Schlumberger's GeoFrame-IESX data stores.

Even the biggest vendors slowly realize that they cannot develop everything by themselves. The industry is changing and I believe that



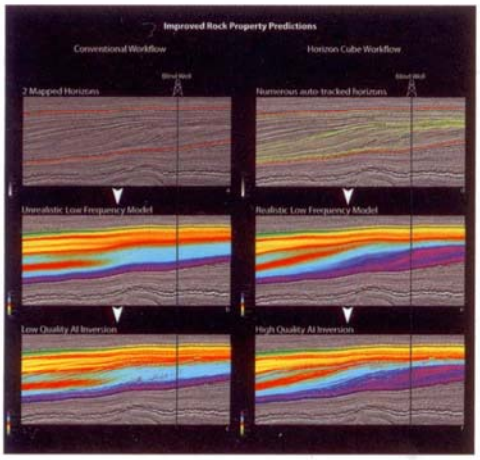


All figures are courtesy of dGB Earth Sciences

this is in part due to OpendTect and its open source model. Collaboration is the key to advancing technology. If we share ideas (and source code) we inspire others. The result is better technology for the end users.

PA: Describe some of the capabilities of the Neural Networks plugin for OpendTect. How does it facilitate seismic interpretation?

De Groot: With the advance of seismic interpretation software, the number of seismic volumes and the attributes that we can derive from these volumes has exploded. Neural networks are used to reduce the sheer amount of information to manageable (read interpretable) proportions. For example we can combine the information inherent in tens of attributes into one single meta-attribute that aids the geo-scientist to interpret fluid migration paths. Another use of neural networks is to visualize seismic patterns by clustering multiple seismic attributes (or waveforms). Finally, neural networks are used in seismic reservoir characterization work flows – for example, to predict porosity or lithology from seismic impedance volumes and well logs.



PA: Please give a few examples of any DGB seismic activities in the Africa region.

De Groot: It's always difficult to reference commercial companies as they like to keep their seismic interpretation activities confidential. We have, however, worked extensively in different countries along the West African coast. Most projects combined fluid migration path interpretation (chimneys) with other advanced seismic interpretation work like rock property predictions and sequence stratigraphic interpretation.

We have also provided our software to a lot of universities in Africa – 27 in total. They include Ain Shams University and Al Azahar University in Cairo, Egypt; Al Neealin University and the University of Dongola in Sudan; the University of Boumerdes in Algeria; and the University of Ghana near Accra.

PA: What further developments do you foresee in seismic interpretation in the coming few years?

De Groot: The arrival of HorizonCube types of technologies (our new version of OpendTect where users can increase the number and density of mapped horizons) will have a huge impact on all seismic interpretation workflows. We will learn that we can extract much more geologic information from seismic data by analyzing the data along correlated stratigraphic events.