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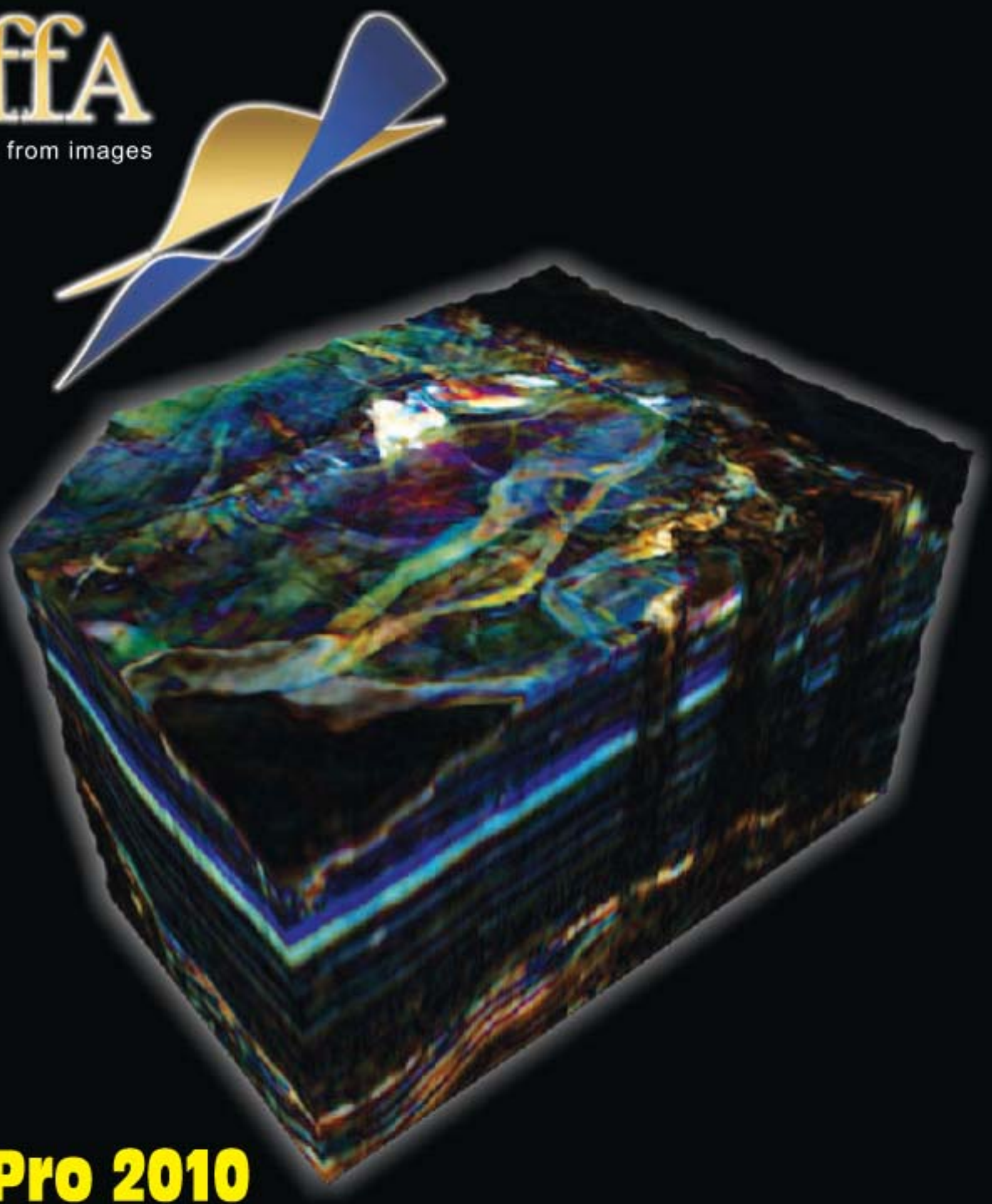


SVI Pro 2010
The gen next 3D seismic analysis tool

The Future of Seismic Interpretation

Jonathan Henderson, Managing Director, ffA.

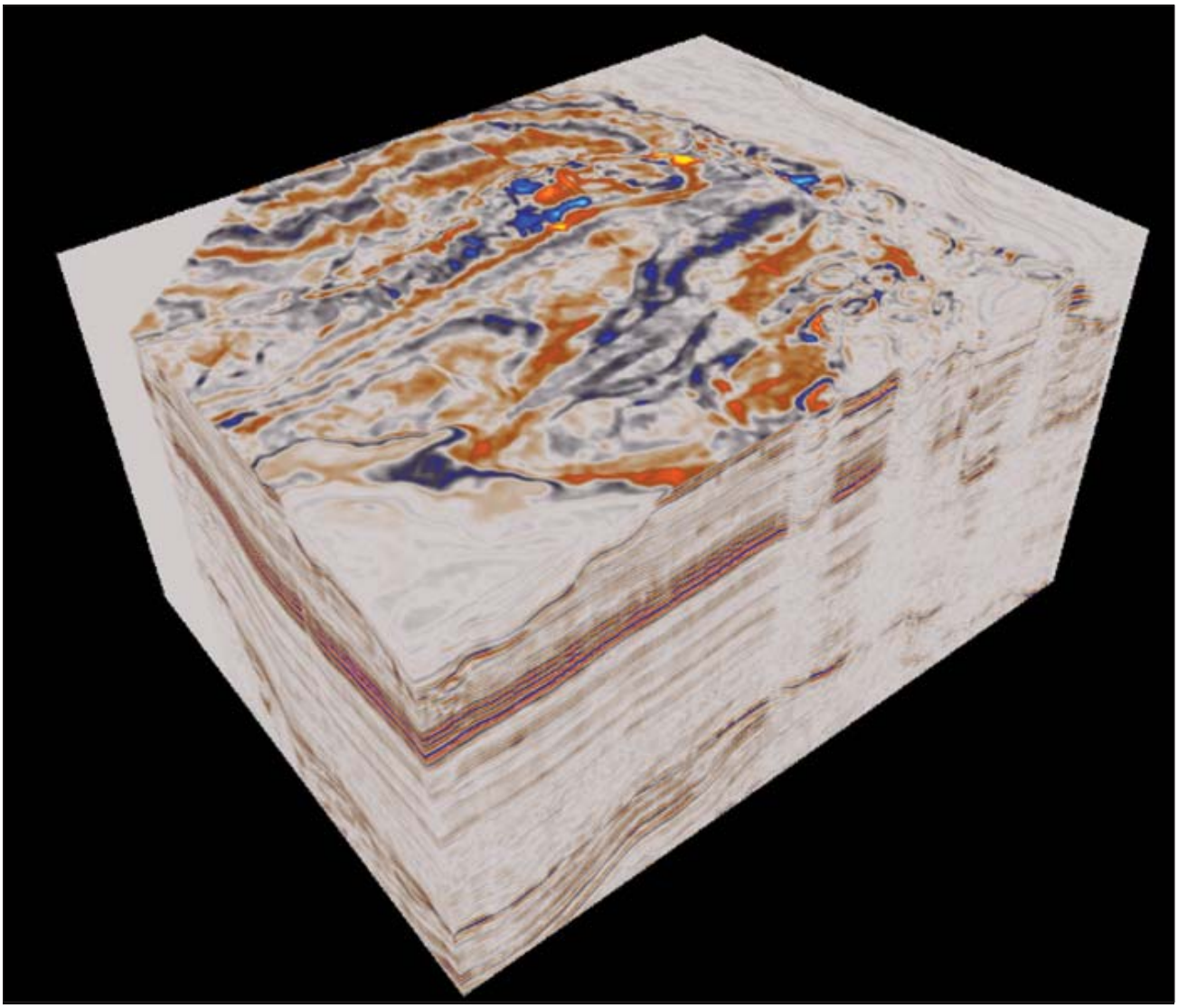
Going forward, 3D seismic data will continue to be a primary source of subsurface information. As we move into the second decade of the 21st century, adequately and efficiently capturing value from 3D seismic data will not happen through simply enhancing existing tools. What we need to do is rethink the interpretation process so that the objective data / image analysis components are seamlessly integrated with the expert / knowledge driven components. Such a system must draw on the good and useful tools in both current interpretation systems and in current 3D analysis applications. But whereas in the past 3D analysis has been tagged onto interpretation, in future, interpretation will be built around 3D analysis. ffA is committed to delivering this step change for its customers and with the release of its SVI Pro 2010 software in January of this year we have taken a significant step towards achieving this. However, there are many challenges remaining and we see the next few years as being a very exciting time. Through our close collaboration with leading E & P companies we are showing what is really possible with 3D seismic data and we are looking forward to sharing this with the industry as a whole.

3D seismic is an extremely successful technology, with E & P companies spending billions of dollars each year in acquiring, processing and licensing seismic data. This investment is made because the impact that 3D seismic has on drilling success is widely understood. Despite the fact that 3D seismic is a very mature technology, with the first survey being acquired in the late sixties, its importance continues to increase. 3D seismic data is still the best, and often the only, source of information that we have about the subsurface beyond the first few metres around the well bore. Gaining detailed, accurate knowledge of the subsurface has never been more critical than it is today, in an age when exploration is significantly more challenging and expensive and where improvements in development efficiency and recovery factors are driven by both political and economic imperatives.

To meet these challenges a huge amount of development work is taking place, more often than not by very small companies, to advance all aspects of 3D seismic technology. 3D seismic is a complex technology with value only being extracted after 3 distinct technical phases: acquisition, processing and interpretation / analysis. No matter what is done to improve acquisition and processing, the seismic image will always constitute a non-unique and ambiguous picture of the subsurface and require interpretation. The harder we push to be able to identify ever more subtle features and extract the imaged geology at greater levels of detail, the more important this interpretation stage becomes.

Initially seismic data was used almost entirely to provide information about geological structure; this involved mapping of geological horizons and major faults from paper sections. The ability to interpret 3D seismic data was greatly increased by the introduction of the interpretation workstation in the 1980's. Although the software utilised was primarily designed to mimic paper section interpretation techniques, they had an enormous impact as they increased by at least an order of magnitude the speed with which a 3D survey could be interpreted.

Petroleum Geophysics



By mimicking paper section interpretation a vast amount of the information contained in 3D seismic volumes is ignored when using conventional interpretation workstations. Although interpretation workstation techniques continue to evolve, for example, with the introduction of auto-trackers and 3D visualisation, a new approach is required to provide the step change in speed, accuracy and quality of information extracted if we are truly to get the return on the investment in 3D seismic. Delivering this step change is ffA's primary focus.

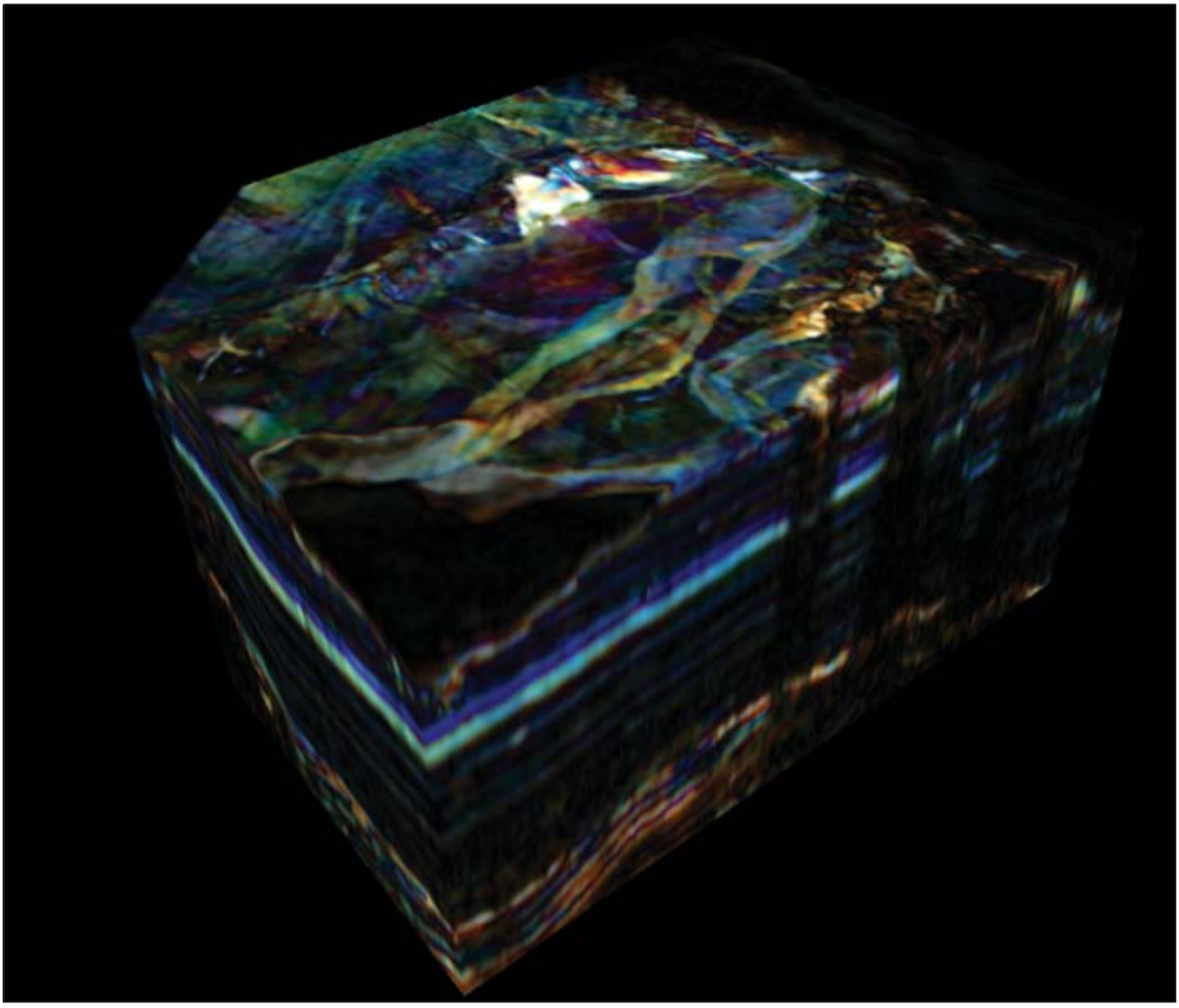
The largest increase in business value will come from identifying and properly utilising much more of the information contained in a 3D seismic data set. This is a challenging task as separating information from variations that are not related to geology is far from straightforward. An example of what can be achieved in this regard is the use of 3D seismic for high resolution 3D fault property analysis. To understand their properties, faults need to be treated as 3D objects, as they are in the real world, rather than as the 2D planes that are produced using conventional interpretation. Objective analysis of the data variations associated with the fault can then be applied to reveal information about potential variations in fault seal capacity along the fault and away from wells. This information can have an enormous impact in the assessment of exploration risk and development strategies.

By increasing the amount of information that we extract from 3D seismic data we can reduce the subjectivity of the interpretation process and in doing so improve accuracy. A recent study by Glasgow University and Midland Valley Exploration has shown that the likelihood of obtaining a correct initial

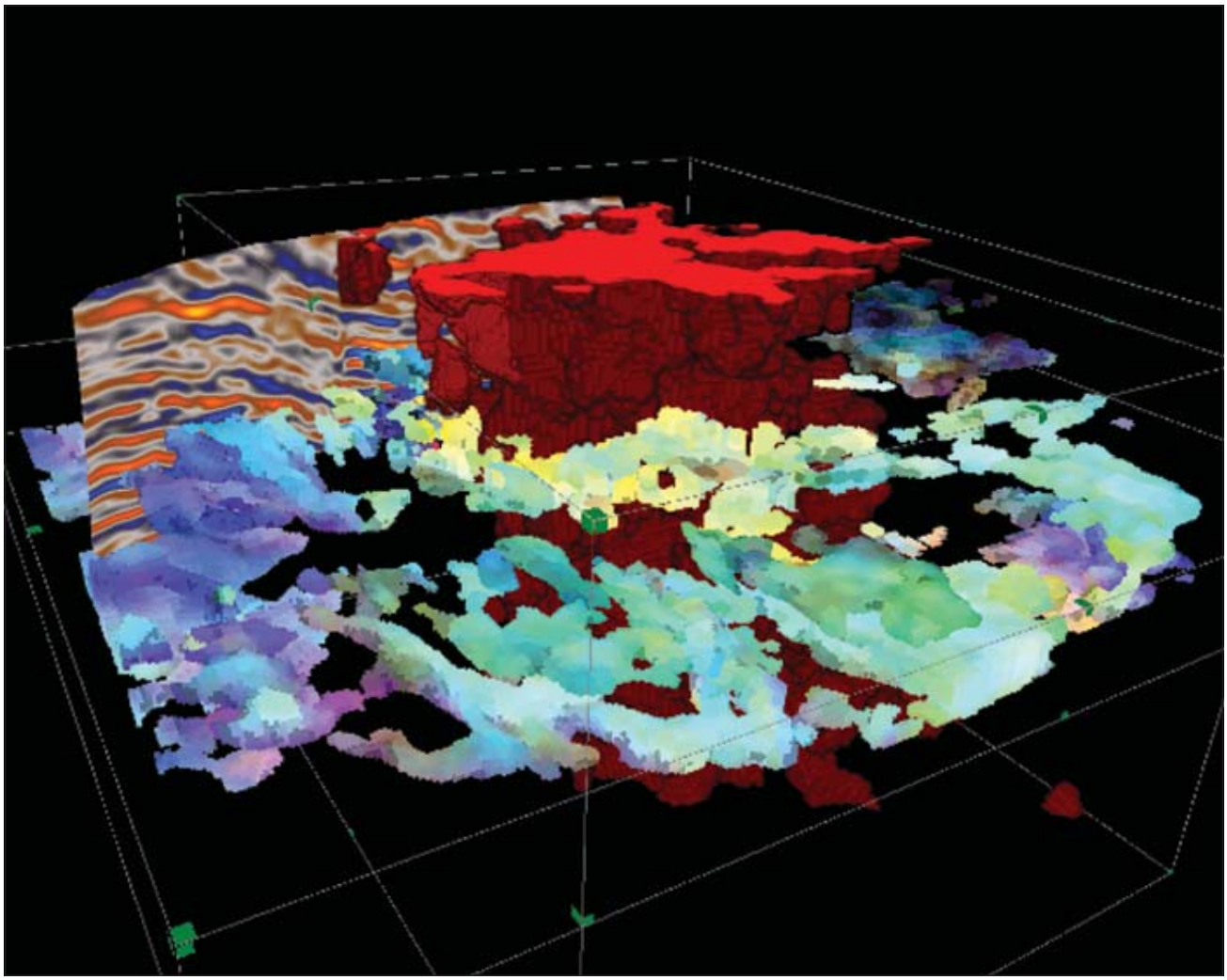
interpretation increases dramatically if multiple methodologies are applied. One way of achieving this is to reveal different facets of the data to the interpreter before they start the interpretation process. With conventional interpretation techniques, which are centred on picking horizons and faults, this isn't possible. What is required is the ability to objectively highlight different signatures within the data and present them to the user in 3D in a visually intuitive manner. The ability to do this quickly and easily is a key strength of ffA's seismic volume interpretation software, SVI Pro.

Once the interpreter understands the geological setting in which they are working they can use the seismic data to help construct a model of the subsurface. By definition, a model can only be an approximation of the real world situation, but to assess the risks and economic uncertainties associated with a particular project we need to understand how good this approximation is. Developing multiple interpretation scenarios required to obtain this understanding is not possible with conventional interpretation techniques because they are too slow and are highly subjective.

The step change in seismic interpretation will not be brought about by replacing the interpreter with a machine but by bringing together as seamlessly as possible the expertise provided by the interpreter and objective 3D analysis techniques. To do this ffA has built its SVI Pro software to make use of the high performance computing capabilities that are available on all modern desktop workstations through harnessing the compute power of both multi-core CPU's in tandem with the workstation's Graphic Processing Unit (GPU). This



Complex channel systems offshore Norway. 3D seismic analysis (bottom image) can show gross and subtle changes in geology that are extremely difficult to detect from viewing the raw seismic data (upper image) (Data Courtesy of Lundin Petroleum).



Rapid, accurate delineation of complex geological entities such as this gas chimney and the surrounding potential reservoir can be extracted quickly and repeatably through allowing the interpreter to utilise their expertise within an objective, interactive 3D analysis framework.

enables complex analysis tasks to be executed on standard desktop workstations orders of magnitude faster than previously. In SVI Pro, high-end processing performance is fully integrated with an interactive visualisation and analysis environment that lets the interpreter obtain alternative views of their seismic data or extract specific signatures of interest in minutes rather than hours or days.

An example of the value that can be obtained by allowing the interpreter to work seamlessly and interactively with their data is SVI Pro's Interactive Facies Classification module in which the interpreter adds or changes the information they put into the process by simply pointing at different features of interest in the seismic data set; the analysis system then uses this information to update its decision model resulting in classification of the seismic data into different seismic facies classes. The decision model is updated so quickly that the interpreter sees a real time response and so can generate different 3D realisations of specific geological features extremely quickly. The geometries of these features can often be so complicated, such as gas chimneys, salt bodies, mud diapirs etc, that to even achieve an approximate representation using conventional techniques might take days if it were possible at all.

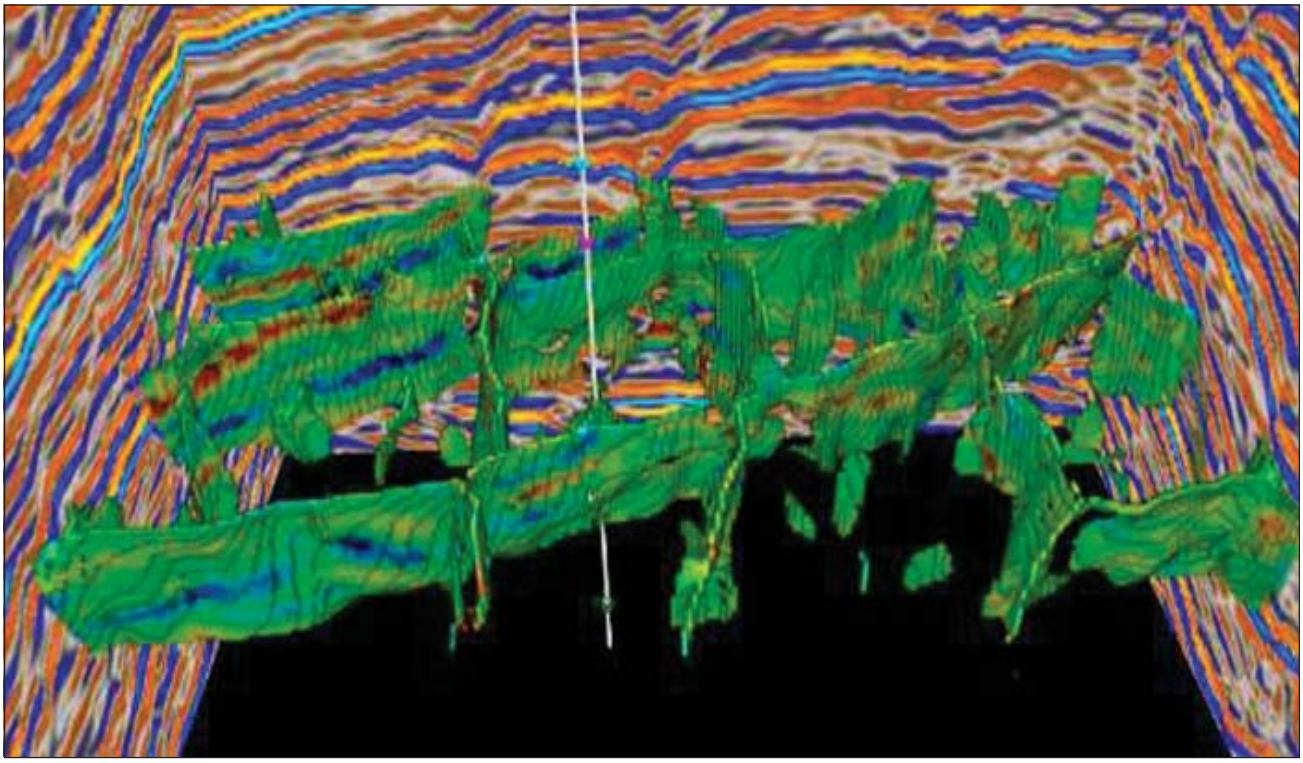
The key to the success of bringing objective data driven analysis into the interpretation does not lie solely in the sophistication of the analysis routines. Of equal importance is ease-of-use. With consumer software products we are now accustomed to being able to use something "straight from the box" and this is a lesson that E & P focused software developer companies are only learning slowly. Ease-of-use is critical. One of the

dilemmas that many technical professionals face is that, despite a desire to use the best tools that are available, finding the time to invest in learning a new software application is extremely difficult. Training in new software applications is always necessary but ffA believes that this training should be directed at showing how to obtain technical and business benefit from the information provided by its software rather than teaching sequences of mouse clicks and keystrokes. ffA prides itself that geoscientists can often obtain information that has the potential to materially impact on their interpretation with an hour of first installing SVI Pro.

Going forward, 3D seismic data will continue to be a primary source of subsurface information. As we move into the second decade of the 21st century, adequately and efficiently capturing value from 3D seismic data will not happen through simply enhancing existing tools. What we need to do is rethink the interpretation process so that the objective data / image analysis components are seamlessly integrated with the expert / knowledge driven components. Such a system must draw on the good and useful tools in both current interpretation systems and in current 3D analysis applications. But whereas in the past 3D analysis has been tagged onto interpretation, in future, interpretation will be built around 3D analysis. ffA is committed to delivering this step change for its customers and with the release of its SVI Pro 2010 software in January of this year we have taken a significant step towards achieving this. However, there are many challenges remaining and we see the next few years as being a very exciting time. Through our close collaboration with leading E & P companies we are showing what is really possible with 3D seismic data and we are looking forward to sharing this with the industry as a whole. dewjournal.com

about the author

Jonathan Henderson is a physicist with over 20 years of extensive experience in imaging and image analysis. His initial interests were in medical imaging, where he had worked on developing new methods for extracting and quantifying the information contained in x-rays and ultrasound scans. Since joining ffA in 2001, he has used his knowledge of medical image analysis to help the Company develop unique seismic image analysis technologies. Jonathan has been Managing Director of ffA for 4 years during which time the Company, its global customer base and its software portfolio have all expanded substantially.



Utilising more of the information contained in 3D seismic data can give important insights in the variation in geological properties, such as fault seal capacity, away from a well bore.