AI Fault Interpretation

A significant new tool for fault detection and extraction, in addition to conventional workflows.

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INTRODUCTION

People. Science. Technology.

Imagine being able to spend more time on complex, interesting tasks, and less on repetitive, time-consuming fault picking. For seismic interpreters, the search for new ways to drive efficiency, capture knowledge and integrate more data into subsurface discovery is over – thanks to Geoteric's new technology stream.

With the combined power of people, science and technology, we've designed an AI-driven platform to maximise your understanding of the Earth's subsurface. Geoteric's software uses the data you've collected to help identify faults in a fraction of the usual time and with a greater level of accuracy. This means you can make objective, informed decisions much faster and strengthen your ability to make inferences and conclusions.

For both individuals and organisations around the world, AI fault interpretation marks the beginning of a new software revolution.

THE CONCEPT IN FULL

Incremental understanding

1. Regional focus

2. Reservoir focus

3. Well focus

A rich understanding of your seismic data requires the application of different methods throughout the workflow. The same concept applies to our AI Fault Interpretation Service offering.

We know there is a relative relationship between data, insight and understanding. For example, a high-level regional screening framework is a necessary first step, this is further refined at a reservoir level and ultimately feeds into the successful development of a well. Therefore, our service offering has been developed to deliver confidence across each step which can be tailored to answer the questions at hand.

Multi-level optimisation

New methods can be readily incorporated into either existing or new workflows at any level. Each of our service-based offerings help to improve your understanding and build your knowledge, giving you an unprecedented picture of the Earth's structure.

The path to success is rarely straight

Designed with flexibility in mind, you can build upon each step as you explore, learn and test assumptions to create a complete picture of the subsurface. With a range of additional service enhancements, each offering can be optimised to add in greater clarity of detail and used in combination with traditional lines of geophysical imaging to increase confidence. The result is a thorough understanding of your data, making it possible to estimate the economic feasibility of a prospect much more accurately.

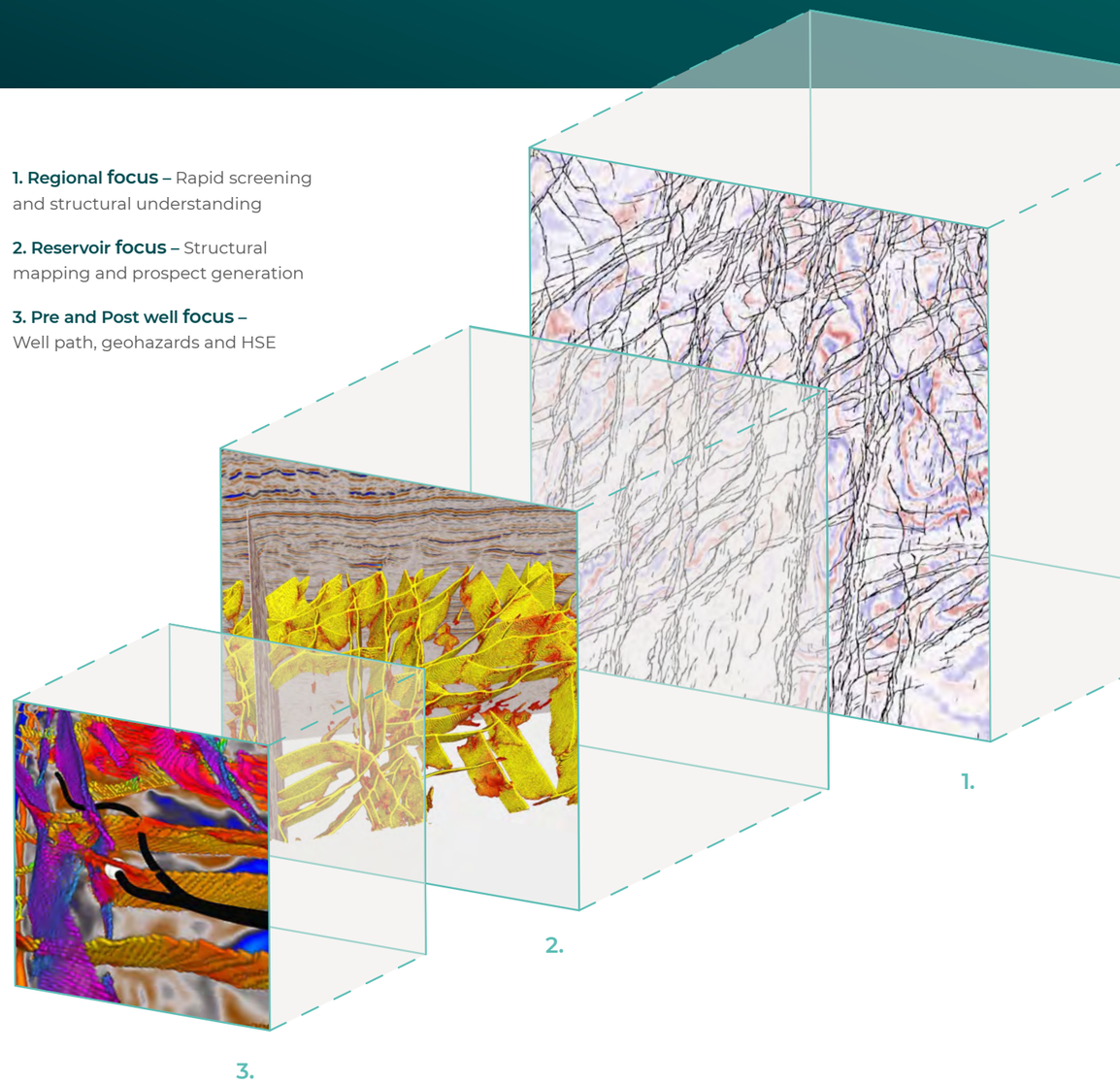
A catalyst for discussion

The initial unbiased AI assessment of the structural framework provides a detailed answer. It is also a great catalyst to discuss, without significant interpreter bias or reputational investment, encouraging a fast, open and comprehensive assessment of the structure.

1. Regional focus – Rapid screening and structural understanding

2. Reservoir focus – Structural mapping and prospect generation

3. Pre and Post well focus – Well path, geohazards and HSE



FIND THE BEST PLACE TO EXPLORE

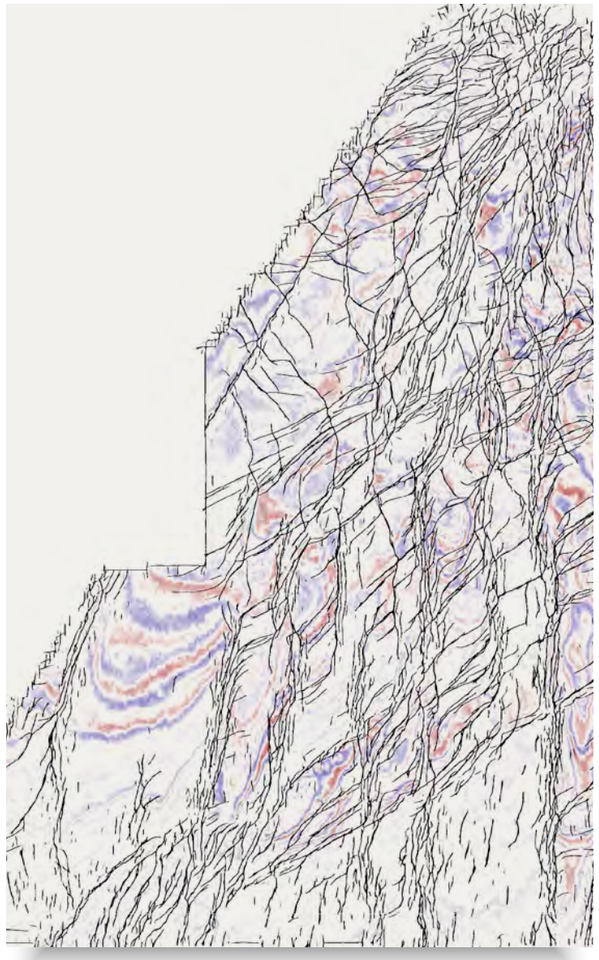
Regional focus

In early stages of projects (exploration or development), large areas are screened to understand the structural geology to determine where to begin focusing efforts. For interpreters, such large areas are highly laborious and very time-consuming, becoming infeasible for large datasets or area with very dense faulting.

Within days, our high-level exploration screening dramatically speeds up structural understanding creating a straightforward view of your seismic data. Delivering significantly greater detail than traditional months-long exploration projects, more time can be spent considering the impact of the structure, making it easier to identify the subtleties required to effectively target potential areas for investment.

Answer the questions at hand

- Where are the potential areas for further, more detailed work?
- What are the dominant structural trends?
- Are there any anomalies?
- Is there a potential connection to a kitchen?
- Is any proposed trap continuous?



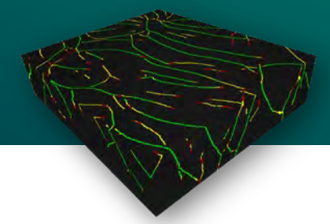
Q&A What is the benefit to me as an interpreter?

AI Faults should be used by an interpreter to provide an unbiased assessment of the structural information in the seismic data. The interpretation detail seen in the projects we have run consistently exceeded anything possible using manual workflows. The AI result can be used directly, or to indicate complex areas that you may want to investigate yourself. It isn't just a case of seeing what is there, you still need to know why it is important. AI Faults empowers an interpreter to reach informed conclusions in a more efficient manner than ever before – time better spent.

Q&A What is an AI fault interpretation confidence cube?

As part of the AI fault interpretation service, a confidence cube will be calculated. This cube transforms the output from the AI process to identify where the faults have the highest probability. It is a simple traffic light system of 'red' for lowest to 'green' for highest likelihood, a visual aid to enable effective fault interpretation assessment.

Example of an AI fault interpretation confidence cube.



Big data set? No problem.

The Southern North Sea dataset covers a massive part of the UK Southern North Sea basin. Geoteric's AI platform computed the entire volume.

The platform successfully detected a countless number of faults, accomplishing an integrated interpretation of many decades of data collection.

a) Southern North Sea data set scale **b)** clean results with minimal background noise **c)** fully computed AI volume showcasing high level detail.

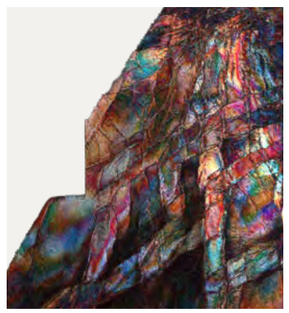
Straight lines indicate the edge of the available data.

Trusted rapid screening and structural understanding in hours.

The greatest concern regarding the use of AI for interpretation processes is whether the results can be trusted. We correlated our findings with published works across the Canning TQ3D survey, and traditional lines of geophysical imaging, such as spectral decomposition RGB colour blending.

01. Published work by K. D. McCormack and K. R. McClay on the structural geology of Canning TQ3D region.

02. AI fault delineation showing clear alignment with published work.



03. Time slice showing frequency blend that verifies the structure shown in 01 and 02.

ASSET EVALUATION

Reservoir focus

The fine details of the faulting become more important during appraisal, production and development. As projects focus on features of interest to fluid flow and production enhancement, a detail orientated analysis is key to evaluate the hydrocarbon potential and asset understanding.

Q&A Will my data be used to develop your AI fault Interpretation service?

No. Geoteric's AI system has been developed using Geoteric only data sets. We will not use any of your data to improve our foundation network. Any fine-tuned network will be securely stored (or deleted) by Geoteric for use on your projects only and will not be used on any other companies' data.

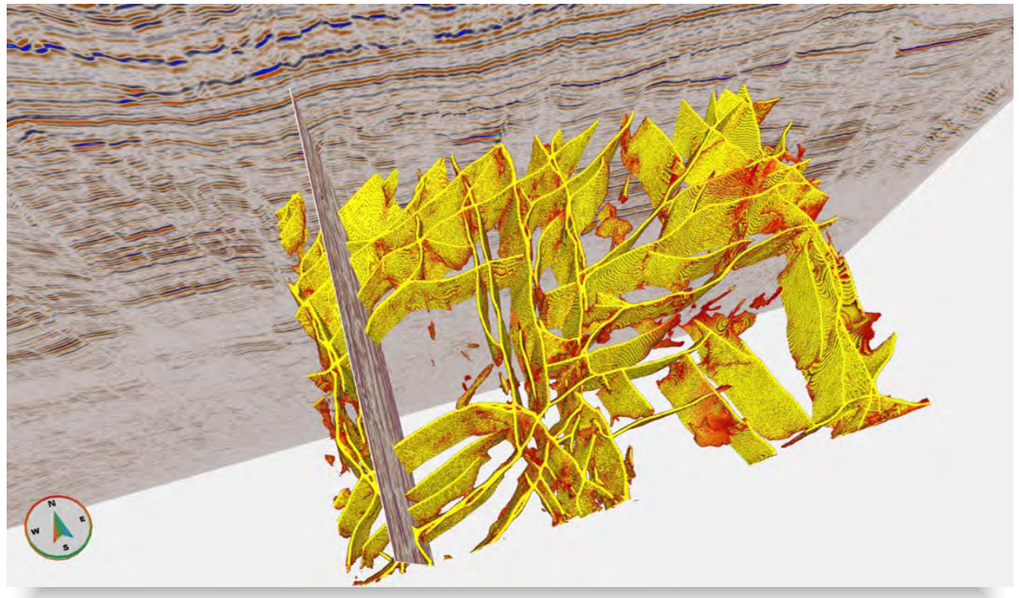
Q&A What do I need to provide?

If we are fine tuning a network very limited data is needed from the client. We will take 1 x in-line and 1 x crossline to aid any fine tuning. This must be supplied to Geoteric together with the seismic data.

Local faults in a region of interest can be delineated to a resolution which could clearly illustrate potential impact on prospective production. Creating a network which is highly tuned for specific nuances of the dataset and target regions ensures all intricacies are considered.

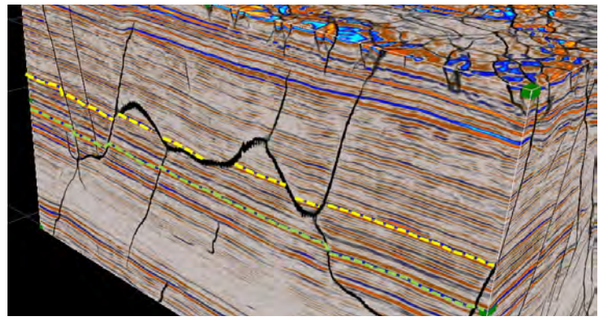
Answer the questions at hand

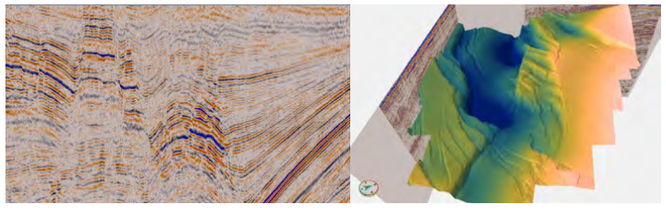
- How should we develop this field?
- Is the field broken up?
- How does the regional framework impact on the reservoir?
- How compartmentalised is the structure?
- Are we safe from water ingress?

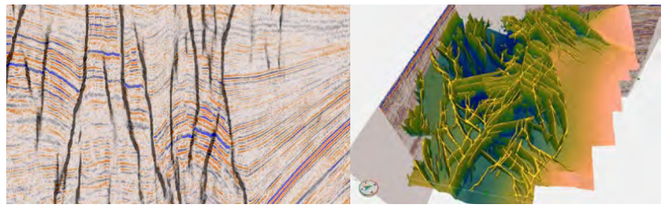


Orthogonal fault planes

Horizon interpretation can be carried out most accurately when the locations of faults are known. Therefore, defining structural elements beforehand is of significant value. For the first time, exploration screening can serve as a structural guideline to highlight details such as intersecting oblique fault planes.







Greater tolerance to low quality data

Subtle details and trends can be difficult to interpret manually. This variable quality data set contains faulting of various scales. The networks are capable of working with a range of data quality, new high-quality data works well, but so does off-the shelf data available today, as shown by our work on publicly available released data sets.

Image - Foundation network showing, complex fault structures were identified in minutes throughout the volume this would likely have taken days to weeks of manual interpretation to unravel.

WELL PATH, GEOHAZARDS, HSE

Well focus

Pre well planning

Assisted well planning

Fine detail of the reservoir and the overburden is critical to successful well planning. Manual interpretation inevitably introduces interpreter bias and considerable subjectivity. The detail AI is able to deliver on the fault network reveals structures that can be extremely difficult for an interpreter to see. A focus on the well trajectory is critical to ensure the well is developed accurately and efficiently, without compromising on safety.

Answer the questions at hand

- Is there a reasonable path between my rig and the target?
- Based on the seismic data will the well encounter any faults?
- Is the proposed injection well going to go to the right compartment?
- Is there an alternative well path with lower risk?

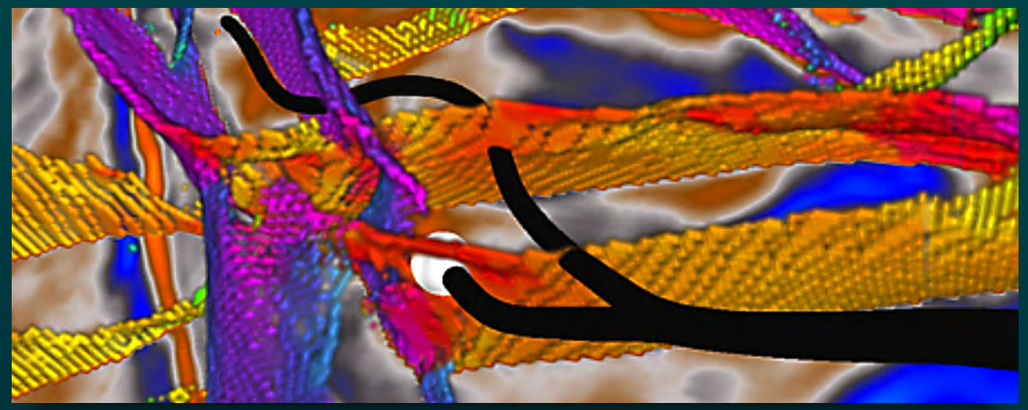
Post well planning

Maximize production revenues

Sometimes it's difficult to understand why wells are not delivering in ways as expected. Quickly and effectively clarify reasons for performance with post drill analysis. Perhaps identify difficult to see elements that may answer that frustrating performance question.

Answer the questions at hand

- Why is the well not performing as anticipated?
- Is there a baffle restricting the connection between the identified volume and the well?
- Is there an additional target, perhaps in a difficult to identify compartment, that should be drilled?

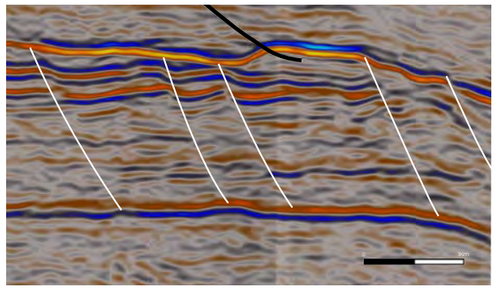


GEOTERIC INVESTIGATES

Why was the well lost?

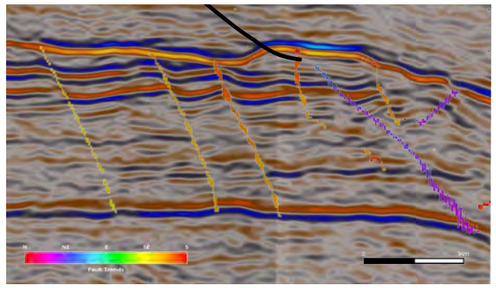
Situation - Traditional fault interpretation

In 2013 the Tern development well (210/25a-A49) encountered wellbore stability issues which led to the subsequent sidetracking of the well. The instability was associated to the presence of a fault which was not interpreted and as a result the risk not fully evaluated.



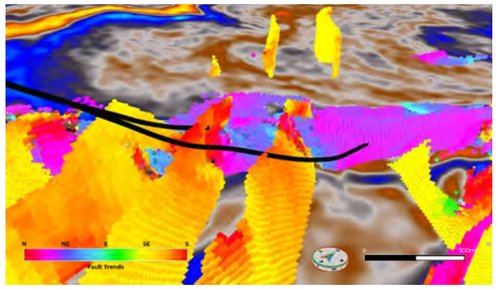
Investigation - Can AI help?

Within minutes, Geoteric's AI Interpretation platform was able to reveal the presence of the previously unidentified faults, leaving our interpreters time to piece together the full geological story.



Results - An AI approach

When coloured by orientation, our AI results illustrate the delicate interplay of the faults. Faults which are oblique or parallel to the seismic section (purple) are notoriously difficult to interpret via a traditional 2D structural approach. They can often be overlooked due to their shallow dipping nature. Only by compiling and visualising faults in a 3D manner can interpreters understand the complexity of the structural network and the subsequent fault linkage and interplay observed here.



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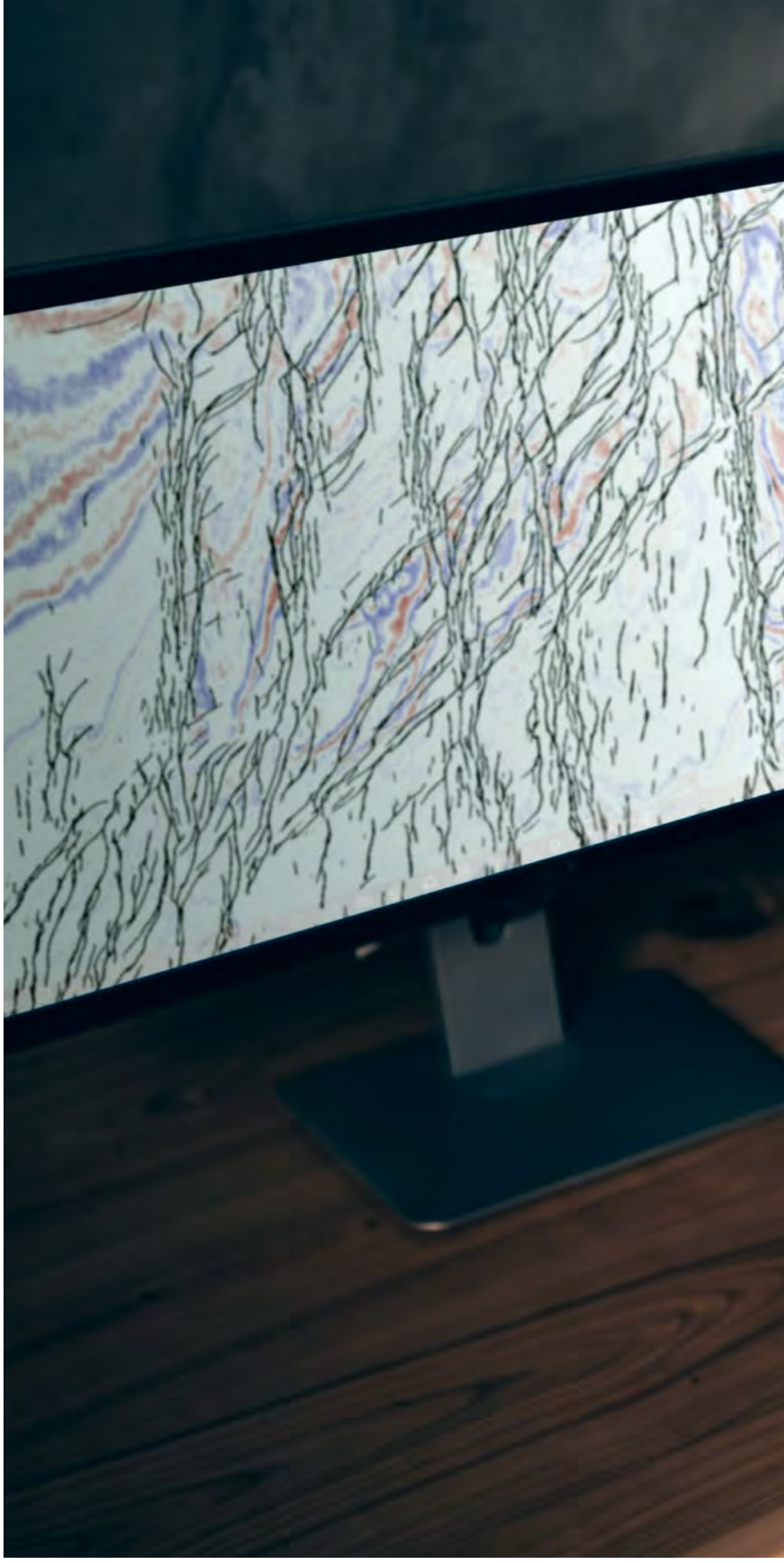

geoteric

Newcastle +44 191 4700 430

London +44 203 7577 750

Houston +1 832 4263 755

Perth +61 861 887 551

Kuala Lumpur +60 321 681 921

info@geoteric.com

geoteric.com

Data courtesy of Geoscience Australia, UK Oil & Gas Authority (OGA), The Geological Society, London.
McCormack, K. D. and McClay, K. R. [2018]. Orthorhombic faulting in the Beagle Sub-basin, North West Shelf, Australia, Geological Society, London, *Special Publications,* **476,** 28 March 2018, https://doi.org/10.1144/SP476.3