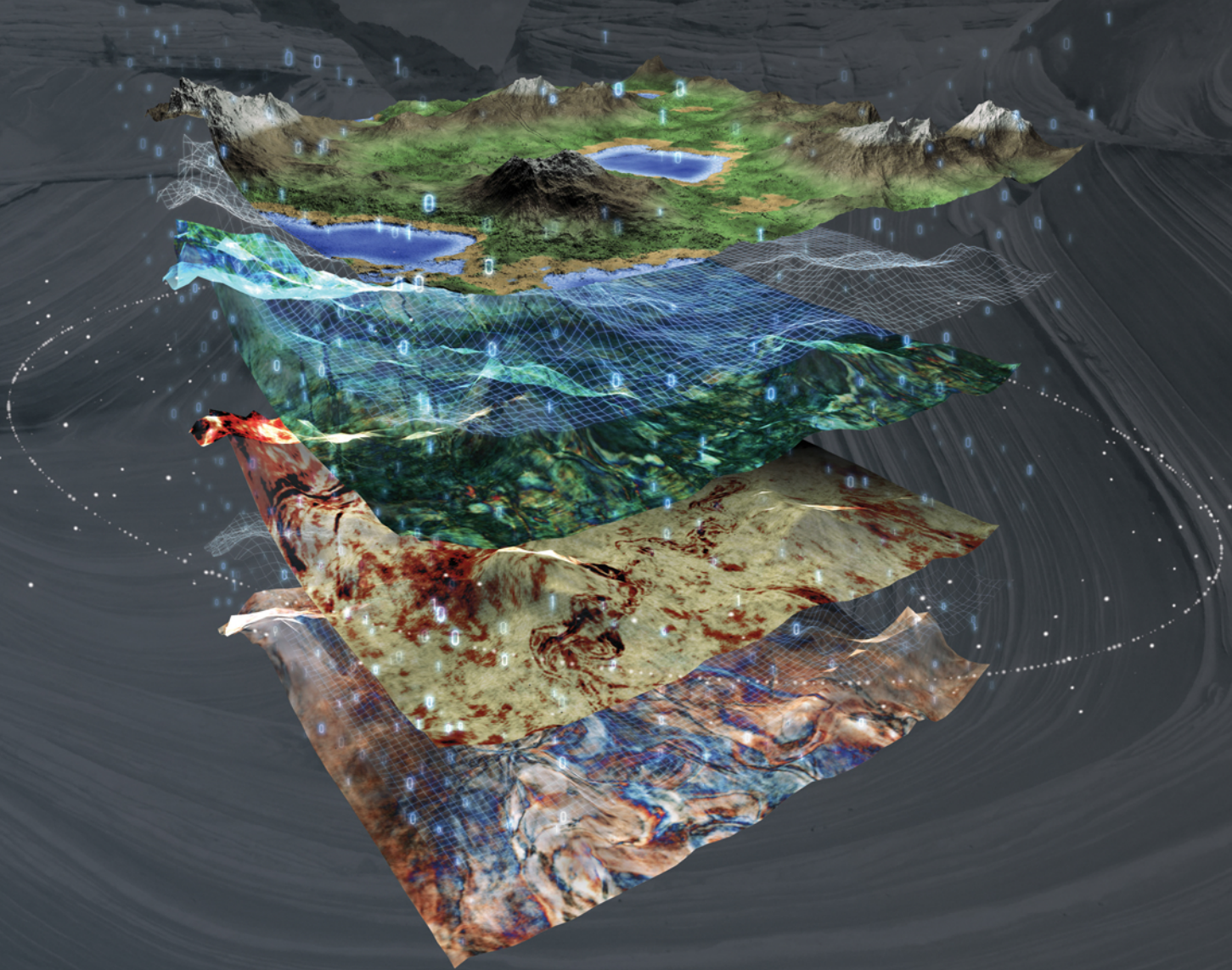


2022

PALEOSCAN™

Integrated Seismic Interpretation Software



Human Intelligence for Earth Solutions

Who We Are

Eliis provides a competitive seismic interpretation software for better understanding of seismic images and successful subsurface investigations.

Our proactive, data-driven and innovative team of geologists, geophysicists, signal processing and software engineers have developed PaleoScan™, a next generation of seismic interpretation software which pushes the seismic analysis to an unprecedented level of geological expertise.

« When human creativity meets powerful technology:
the key to unlock your seismic data »

Our Ambition

Over the years, Eliis has become an internationally recognized provider of subsurface geoscience solutions. Its technology, know-how and services are used around the world in many areas, from the exploration and production of fossil energy, and the strategic storage of gas. Eliis' disruptive technology, used for the detection and characterization of geological reservoirs, is a key asset for stakeholders in limiting environmental risks and offering sustainable energy solutions.

Our mission is to combine artificial and human intelligence, bringing together the automation provided by a modern software and the expertise of geoscientists. That synergy enables the creation of geological models of unmatched resolution directly from the seismic data. Thanks to our technology and methodology, the interpretation cycles are drastically reduced and the capacity to detect and accurately characterize geological reservoirs is greatly augmented.

Today, Eliis has a global footprint with offices in the main regions of the world and is broadening its scope to new markets by adding value to the whole geoscience realm. Eliis is becoming an actor in the energy transition offering solutions to the challenges of a sustainable future.



What we offer



TRAINING



SUPPORT



CONSULTING



MENTORING

Eliis provides a wide range of services, on-site or in-house, from tailor-made training and support to full consulting services. Our experienced consultants, combining deep technical and scientific knowledge, and cutting-edge technology can help you succeed throughout the E&P lifecycle. Eliis' dedicated pool of experts can assist you to solve your interpretation challenges by leveraging the most of our technology.

« For every project we accompany you to find the most
fit-for-purpose solution to help you reach your goals »

Why Choose PaleoScan™?

At the confluence of powerful algorithms, computational power and data analysis, our revolutionary technology pushes your seismic interpretation to an unprecedented level. We can deliver a substantial qualitative and quantitative change to E&P businesses by creating new opportunities for energy supply enhancement, reducing risk and making timely and enlightened decisions.

Innovative Solutions

Eliis' innovative approach is based on semi-automated global seismic interpretation workflow which uses a cost minimization function to generate a chronostratigraphical framework unique to PaleoScan™. This specificity, remaining the core engine within PaleoScan™ platform, is designed to automatically compute a Relative Geological Time (RGT) model directly from the reflectivity responses in seismic data.

A Holistic Approach

PaleoScan™ disruptive technology aims to work at the seismic expression scale to automatically derive a consistent geological model that encompasses structural and stratigraphic discontinuities, such as faults and stratigraphic changes.

PaleoScan™ will change your perception of seismic data and dramatically speed up your interpretation cycle.

Integrated Solution

Since 2007, Eliis has been at the forefront of technical innovation in the seismic interpretation domain developing a fully integrated 2D & 3D platform that leverages a unique global stratigraphic framework and machine aided workflows to accelerate the interpretation process whilst reducing inherent uncertainty.

High Resolution

PaleoScan™ powerful algorithms enable sub-seismic resolution interpretation. An unlimited number of horizons, or depositional time surfaces, can be generated from the model and subsequently extracted as dynamic series of horizon stacks. An interactive stratal slicing can be performed through the seismic volume where sedimentary and structural features can be highlighted with a strong precision. The RGT Model therefore opens a multiple interpretation and analysis workflows that allow the user to perform detailed stratal slicing that is both geologically and signal consistent.

Increased Productivity

PaleoScan™ innovative solutions deliver high quality results that further our subsurface understanding, adding value throughout the E&P value chain, from prospect generation to reservoir management

A dedicated support team

Our Geoservice and IT teams based in Montpellier (France), Houston (Texas, USA), Perth (Australia), Kuala Lumpur (Malaysia) and Rio de Janeiro (Brazil) provide first-rate support, training and consulting to PaleoScan™ users both online and onsite.

PaleoScan™ delivers throughout the value chain

Data Reconnaissance

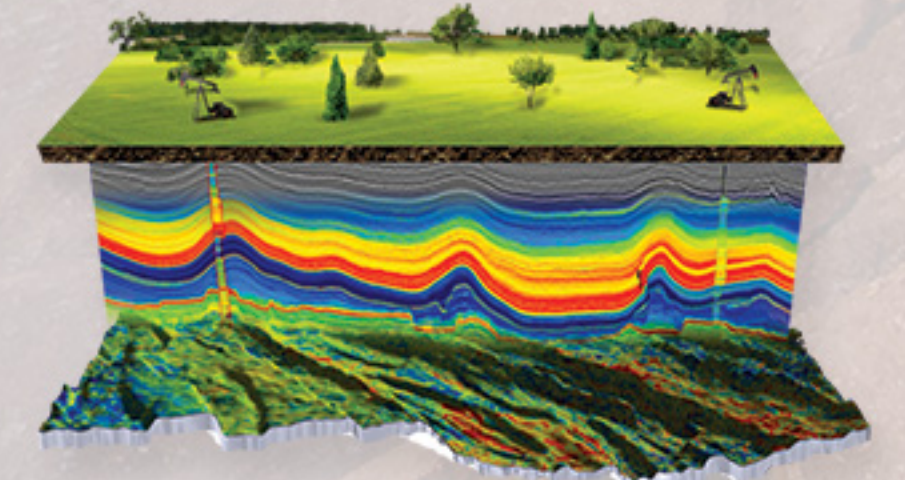
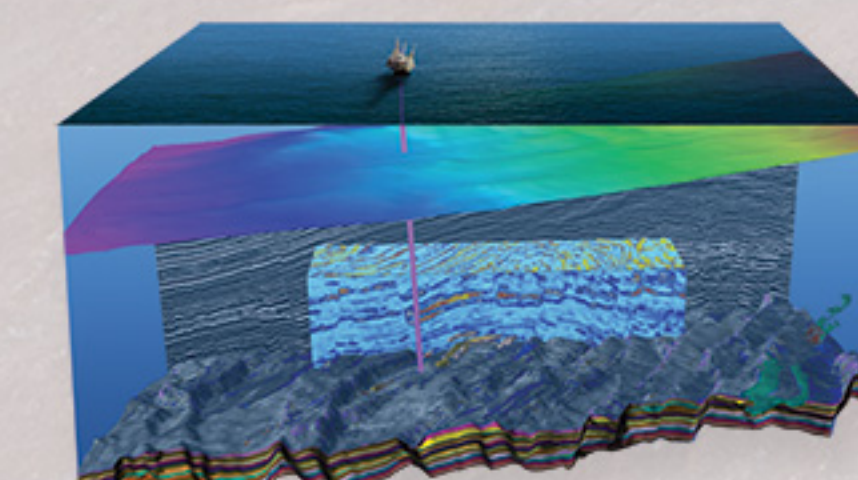
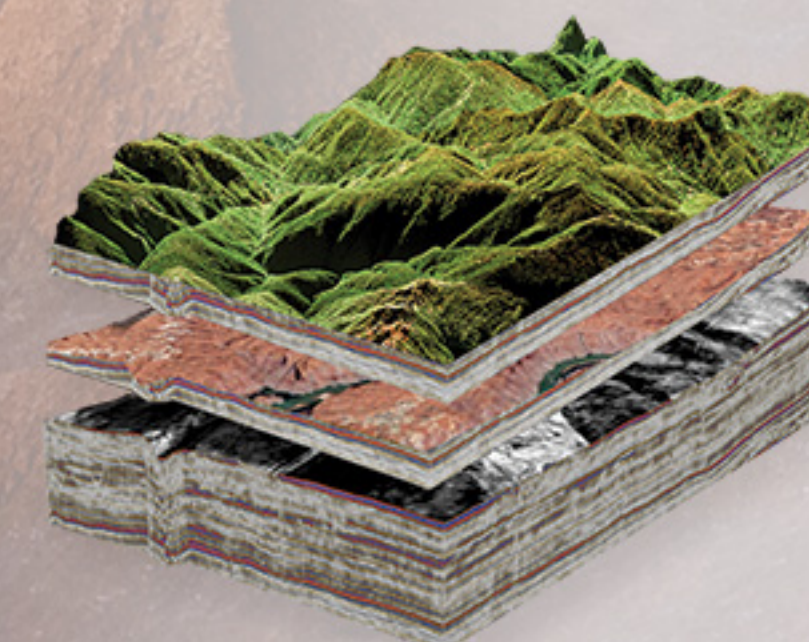
In frontier exploration, new ventures and large scale projects, PaleoScan™ allows the geoscientists to quickly assess the hydrocarbon prospectivity of seismic datasets. It has proven its value in a large variety of basin evaluations, data room situations, and became invaluable in peer review processes.

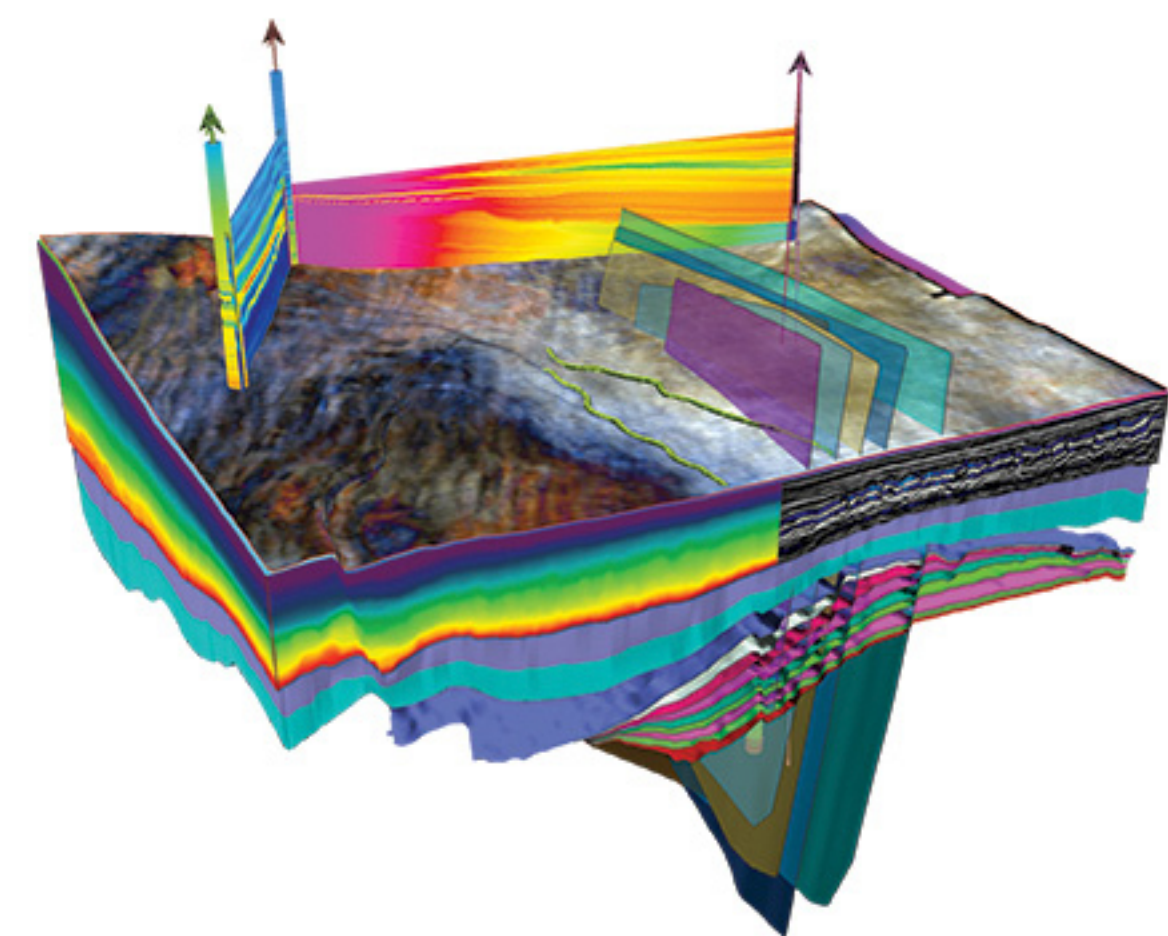
Exploration

Identify prospects and delineate reservoir geometries at an early stage of the exploration cycle. Innovative tools to map seismic attributes on a multitude of horizons and calculate volumes via geobody extraction are crucial for de-risking drilling decisions and defining next well location.

Development

Understanding reservoir properties and architecture with high resolution stratigraphic analysis and detailed fault imaging helps to better constraint your reservoir model and gridding process. PaleoScan™ includes intuitive QI tools including rock-property prediction and data classification through cross-plotting.





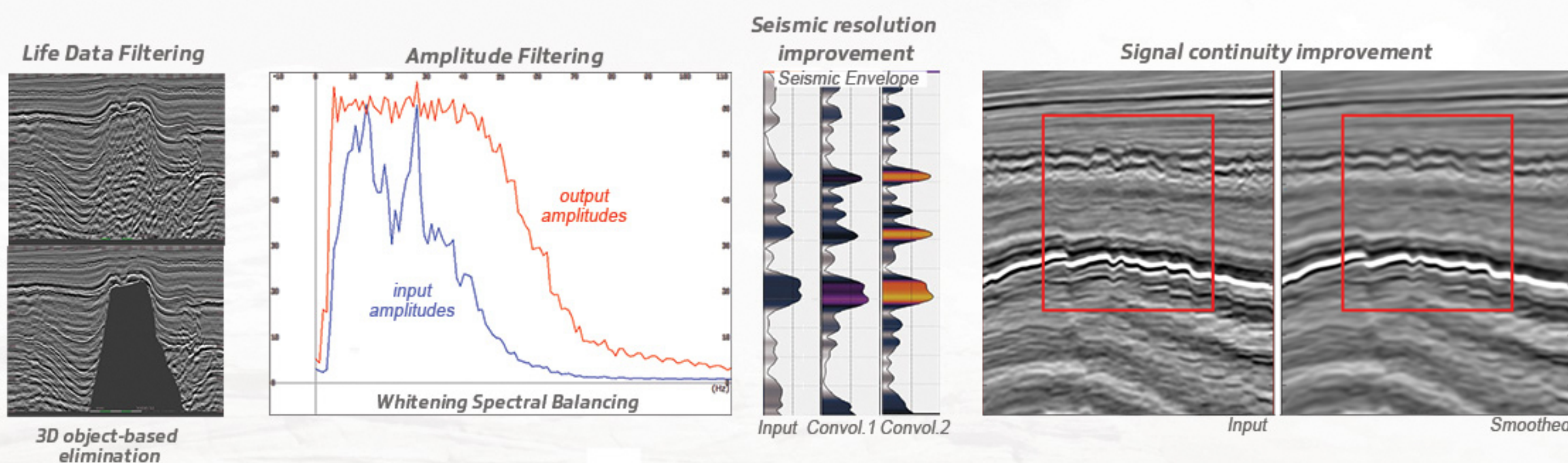
Full Featured Seismic Interpretation Platform

PaleoScan™ includes all the necessary tools to run a comprehensive workflow, from data loading to generation of interpreted objects in a user-friendly environment. Thanks to rapid data screening, interactive cross navigation and powerful editing tools, the interpretation can be refined at its finest and geological models can be previewed in real time. A suite of applications allows semi-automatic generation of horizons, stratal-slicing of the entire volume, geobodies extraction and quantification, automated faults extraction, and wells and markers cross correlation.

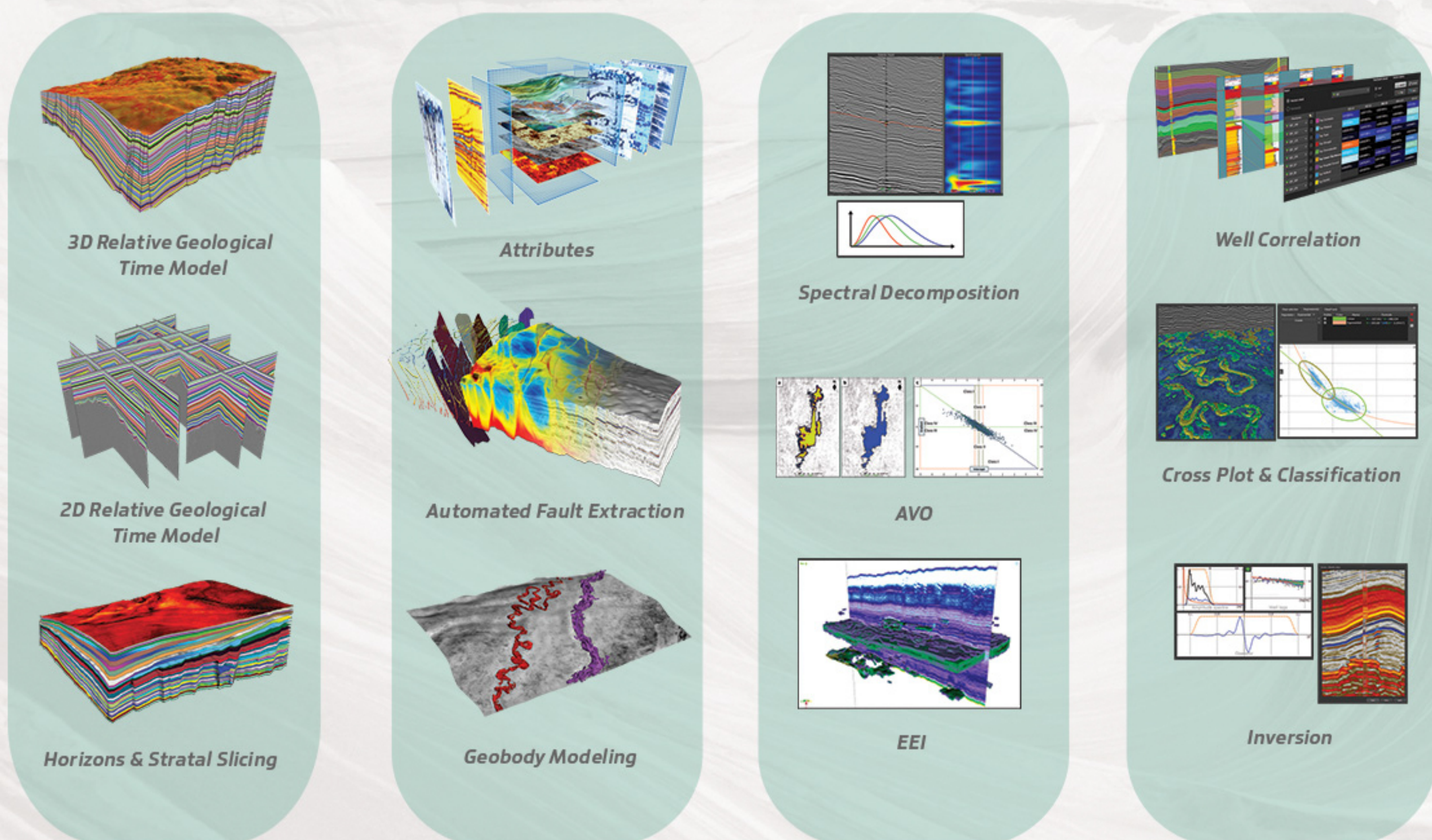
PaleoScan™ runs on Windows® 64-bit and takes advantage of parallel computing with multi-core technologies.

Data conditioning tools

Seismic data conditioning is a key requirement for any quantitative seismic interpretation and reservoir characterization project. In this regard, PaleoScan™ offers specific processing routines to mitigate multiples and noise, enhance amplitudes and eventually correct frequency distortions and other undesirable effects.

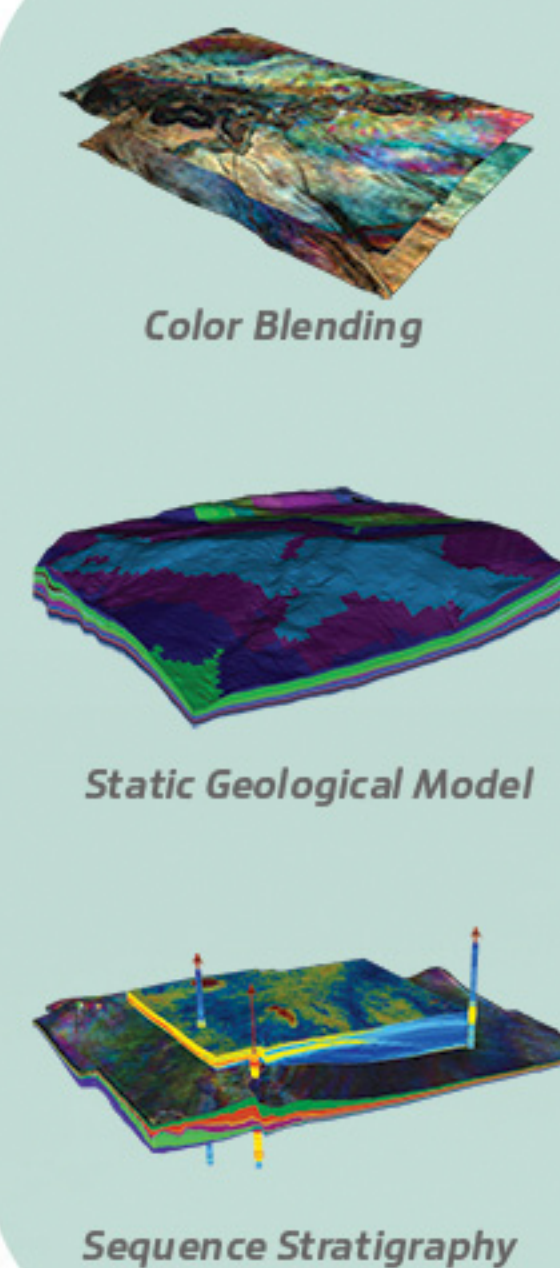


Core Application

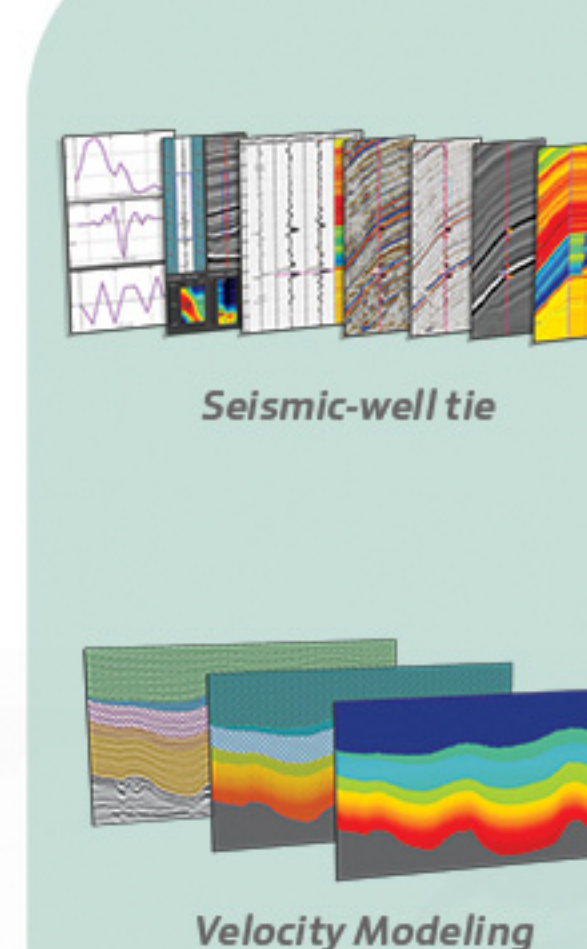


Add-On Modules

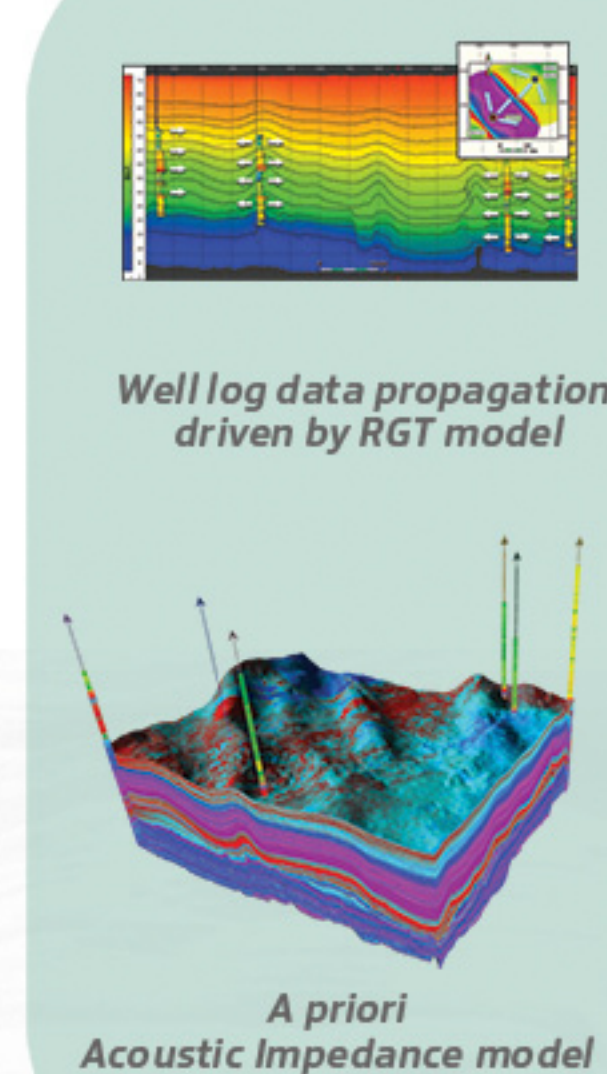
Advanced Interpretation



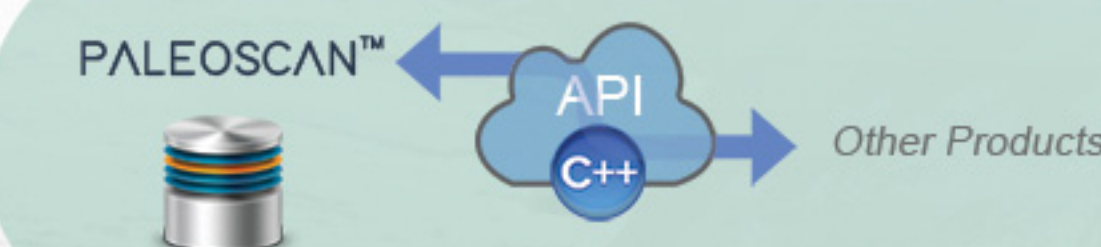
Time Depth



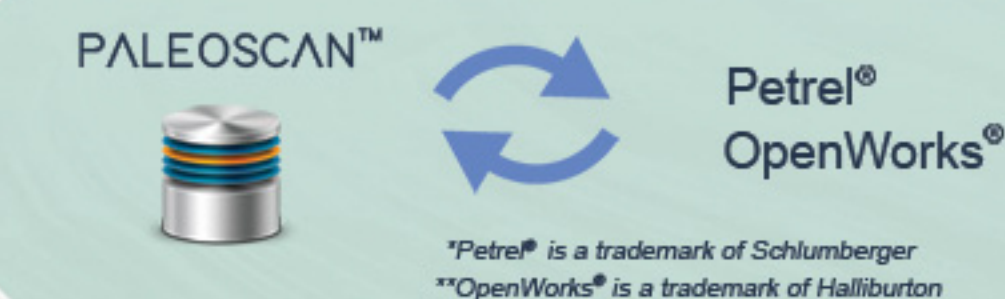
Property Modeling



Data I/O API



Connectors



Python API



PaleoScan™ Data Loader

The quantity and the quality of 3D seismic surveys improved through the 1990s as data was acquired and reprocessed for different types of use. The amount of available seismic data increased exponentially to support critical decision making, requiring additional storage needs and also solutions for subsurface data access and management.

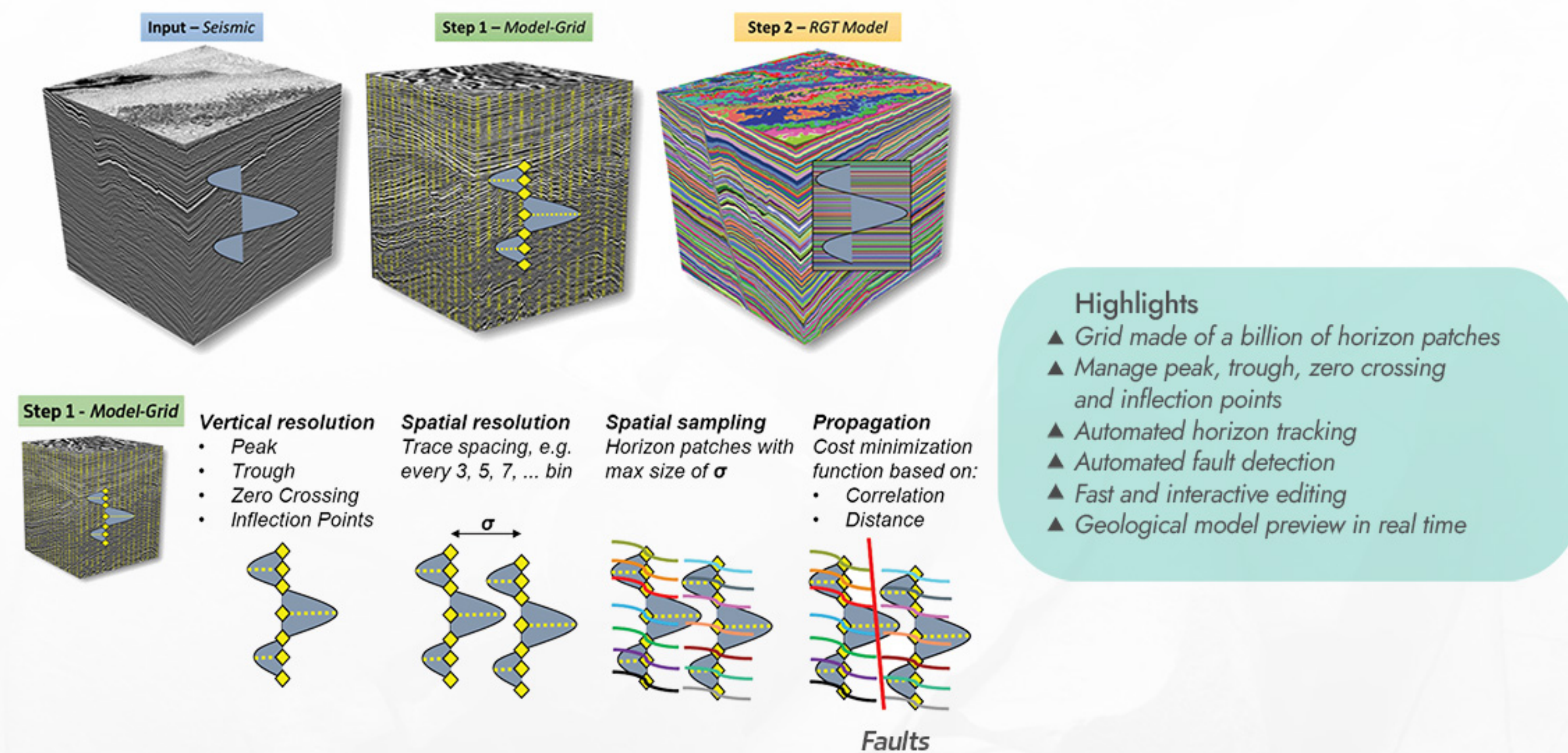
In this regard, a dedicated solution for data management has been developed in order to prepare and quality control the project data before transferring it to the asset teams.

The PaleoScan™ Data Loader enables the users to easily import, pre-view and quality check input data as well as export all PaleoScan's objects and generated outcomes.



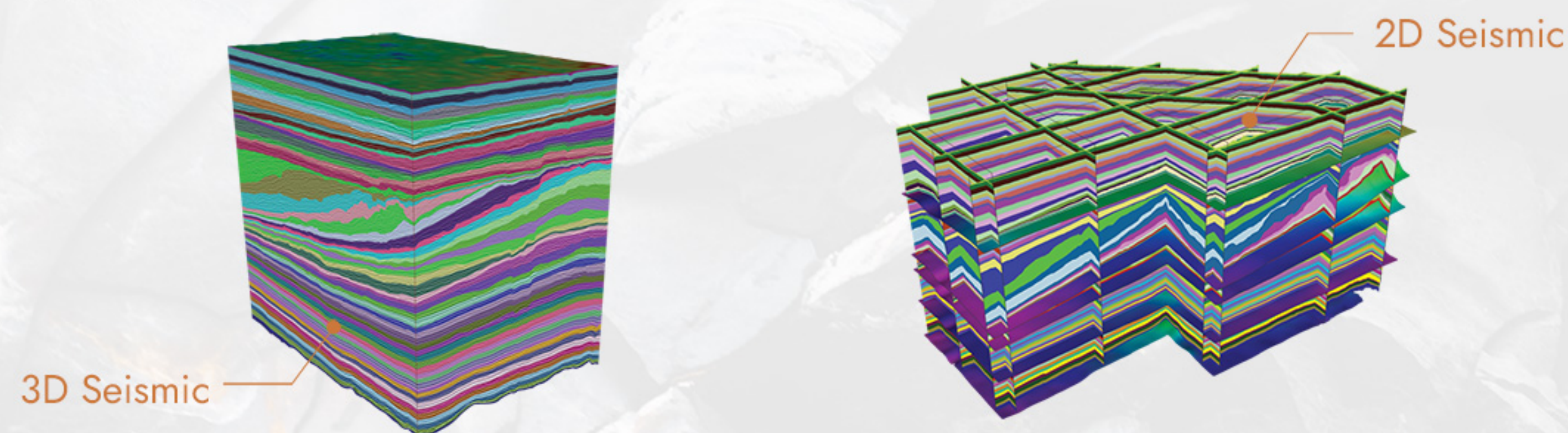
RGT technology

Don't waste time on horizon picking, master our RGT technology and create value from your entire seismic cube in one click! Adopt our holistic and semi-automated seismic interpretation approach based on an iterative Model-Grid and Relative Geological Time (RGT) model creation process.



This comprehensive method utilizes a three-step computer-aided workflow :

- **Autotracking:** our powerful algorithm converts all seismic reflections into horizons and organizes them stratigraphically.
- **QC and Iteration:** flexibility and ownership is given to the interpreter who can interactively edit auto-tracked horizons and update the Model-Grid in real-time to obtain a fit-for-purpose solution. Repeated cycles of adjustments enable to refine the product to the desired result.
- A **Relative Geological Time (RGT) model** is consecutively computed from the seismic based on the aforementioned refined Model-Grid. The RGT model plays a central role in PaleoScan integrated workflows as many interpretative applications are directly derived from it.



2D Seismic Interpretation Method

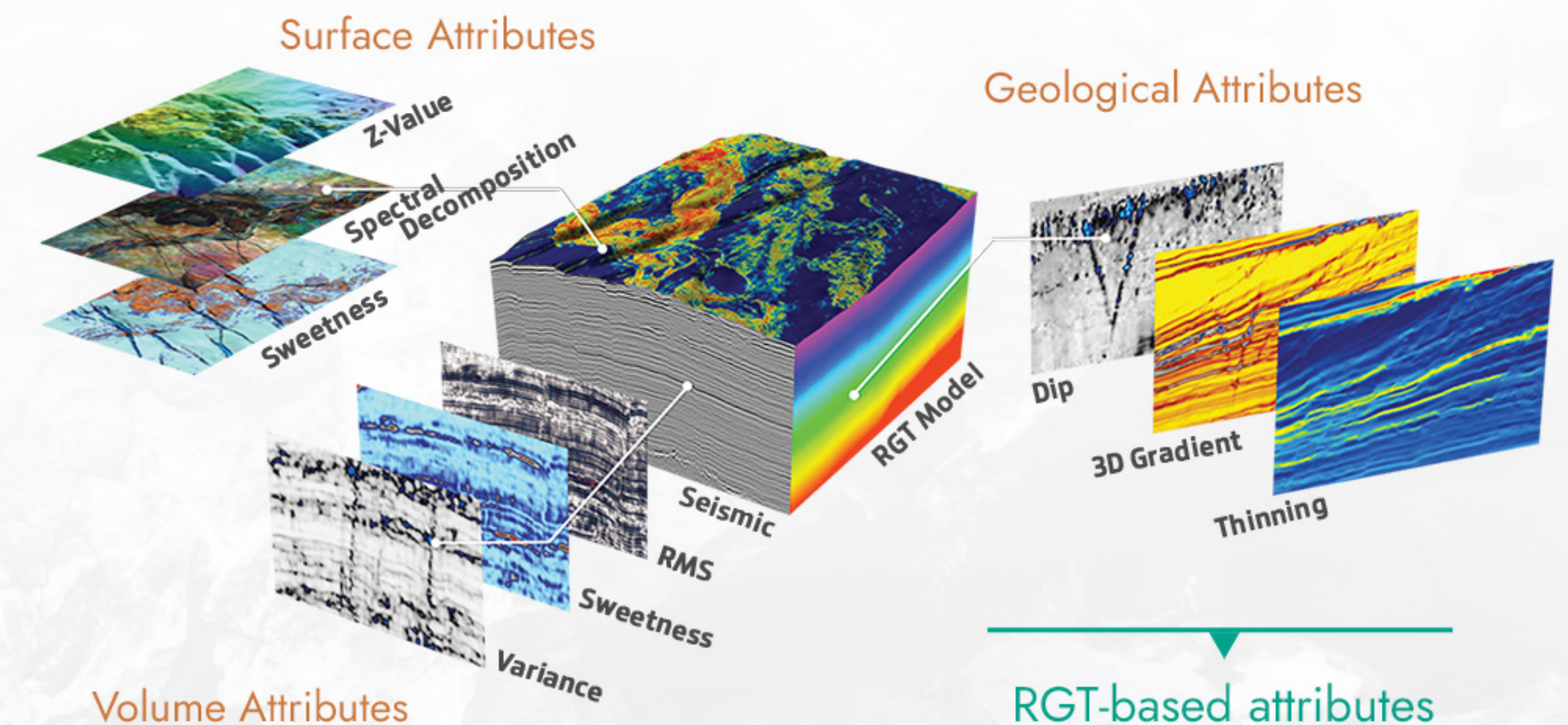
2D seismic interpretation is a generally complex task, relying on 2D auto-tracking and manual picking of major stratigraphic events. Interpreters must extend this process to multiple lines, sometimes of various resolutions, amplitude ranges and mistie effects. Hence, it is often cumbersome to outline the main stratigraphic geometries from 2D interpretation. To ease this process, the Relative Geological Time model method has been extended to 2D seismic data. Based on seismic polarities, a 2D horizon patch grid is computed and patch links are automatically derived via a minimization process. Relative Geological Time values are assigned to the marked horizons and intermediate values are calculated on the remaining patches using a thickness optimisation method. This approach produces a consistent 2D RGT model honouring stratigraphic discontinuities and compensating misties at 2D seismic lines intersections.

Attributes

Whether you are at the dawn or the dusk of your interpreter career, our 3-star workflow relies on our “body and soul” stratigraphic attributes: Spectral Decomposition and Thinning.

- **Spectral decomposition** is a technique relying on the transformation of each individual 1D seismic trace into a 2D time-frequency representation using either Short Time Fourier Transform (STFT) or Continuous Wavelet Transform (CWT). It aims at extracting discrete frequency magnitudes to tune beds according to their thicknesses and provides high precision imaging of source-to sink systems and reservoir complexity and heterogeneities.

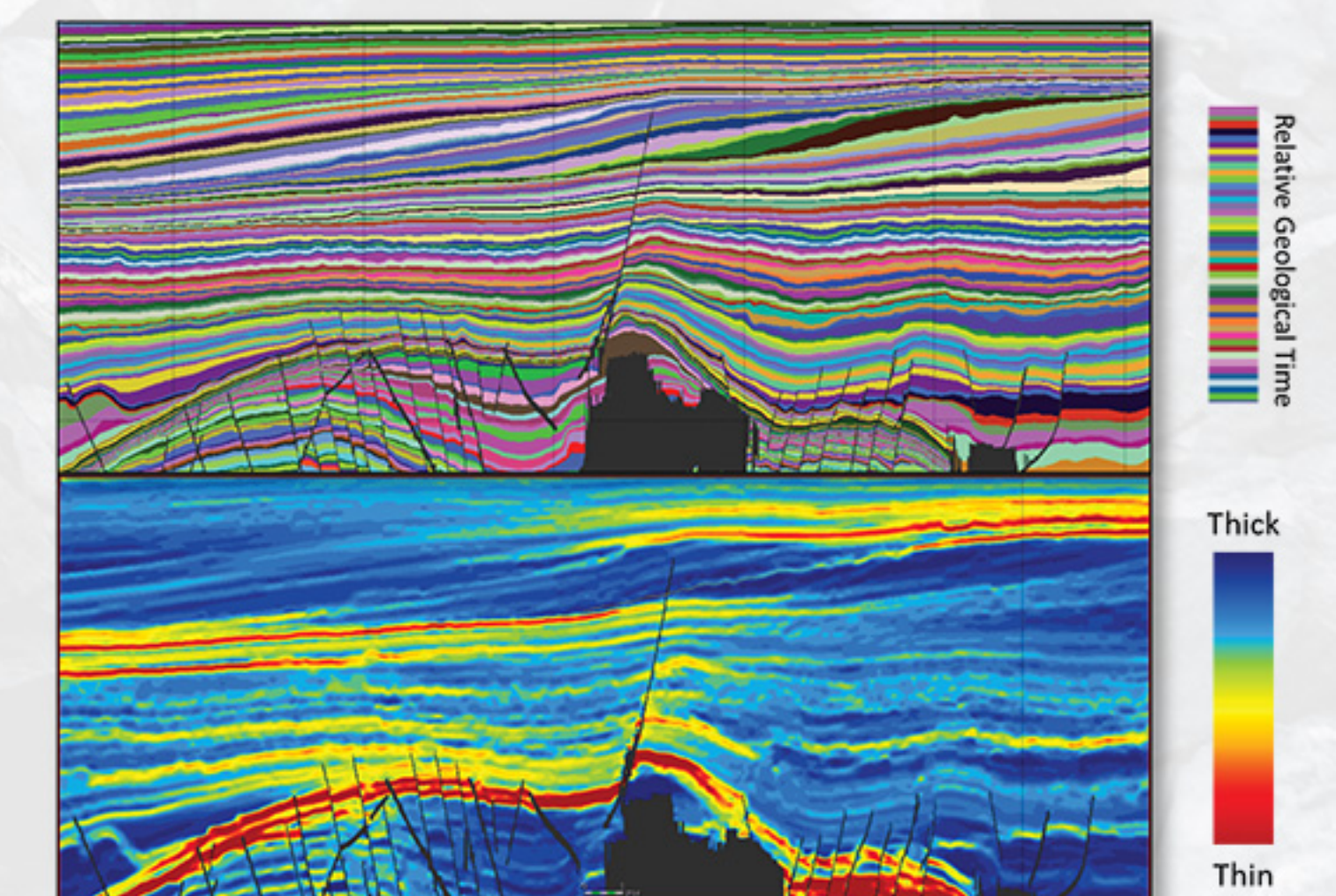
Seismic-derived attributes



- **The thinning** attribute is the vertical derivative of the RGT Model. It shows for every seismic sample the instantaneous variation of the relative geological ages. It highlights zones of strata convergence and divergence leading to the interpretation of geometrical relationships within sedimentary units, relative accommodation space variations and seismic stacking patterns.

From the RGT workflow, you can instantly visualize more than 30 attributes and realize more than 40 attributes derived from seismic or RGT model.

Experience our RGT-based attributes!



Sweetspotting at an early stage

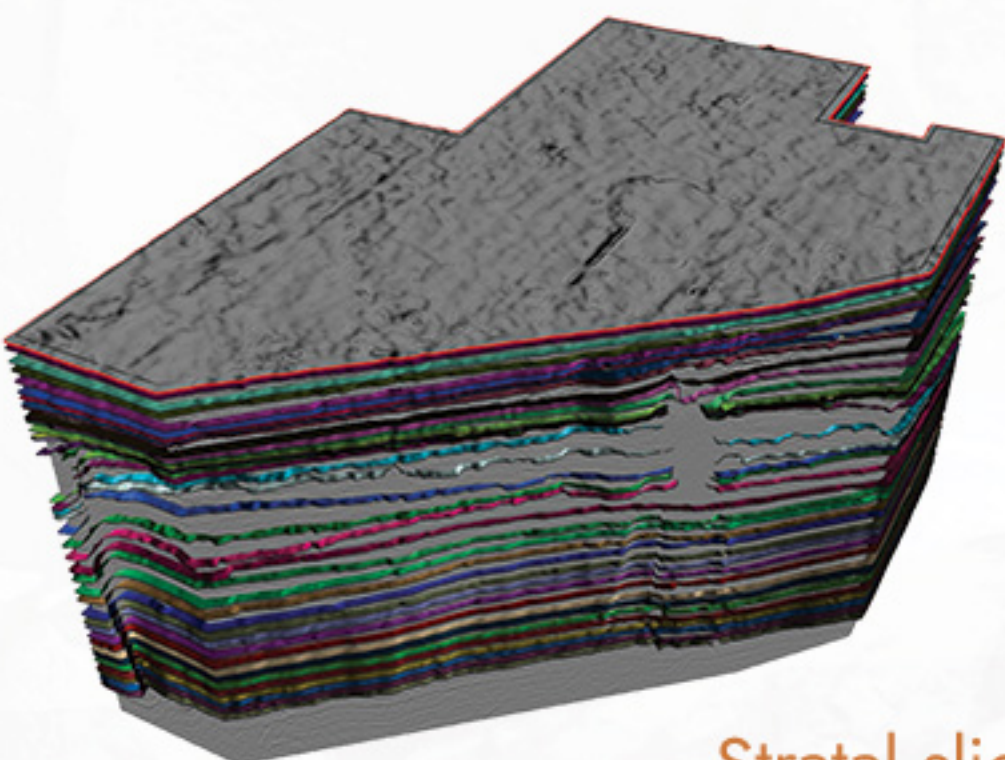
Explore your seismic volumes faster, further and beyond the seismic sampling!

To quickly assess your depositional environment and target sweetspot areas at an early stage, try our quick and pragmatic method!

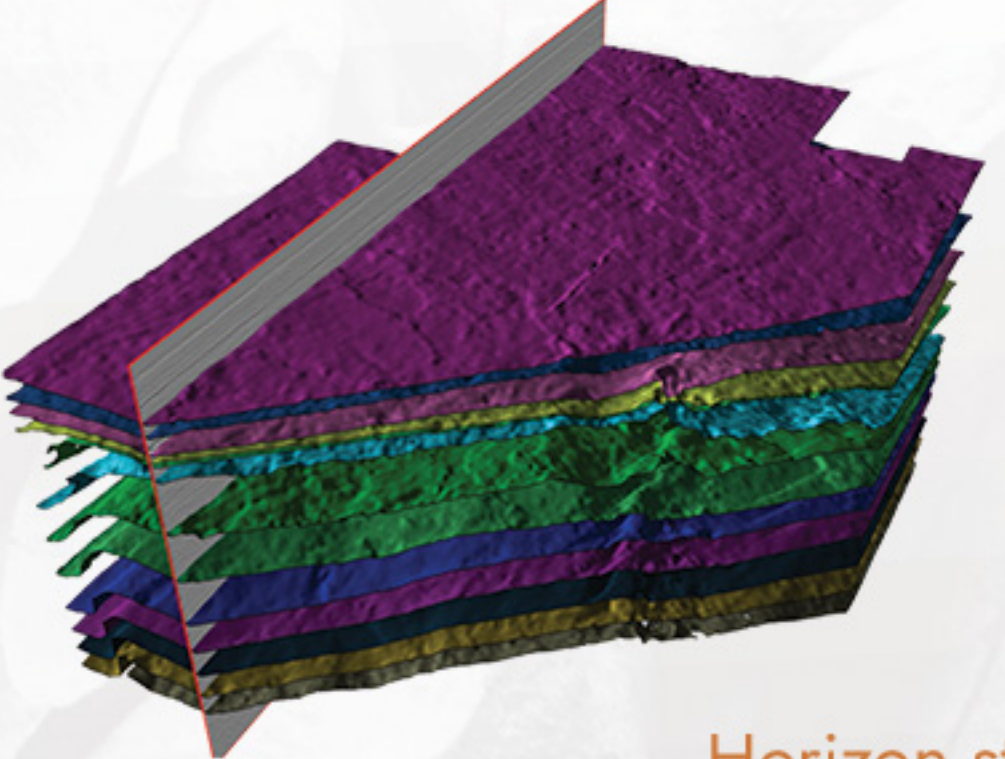
One of the main applications derived from the RGT model is the ability of extracting an **infinite number of iso-age surfaces** gathered within a so-called **"Horizon stack"** product. This high-density **stratal slicing** enables to interactively tie any key surface to major event and dynamically flatten or sculpt the data allowing you to accelerate data recognition, detection and characterization of fine-scale geologic features.

Map your attributes on any horizon and start screening through your geomorphological data in no time!

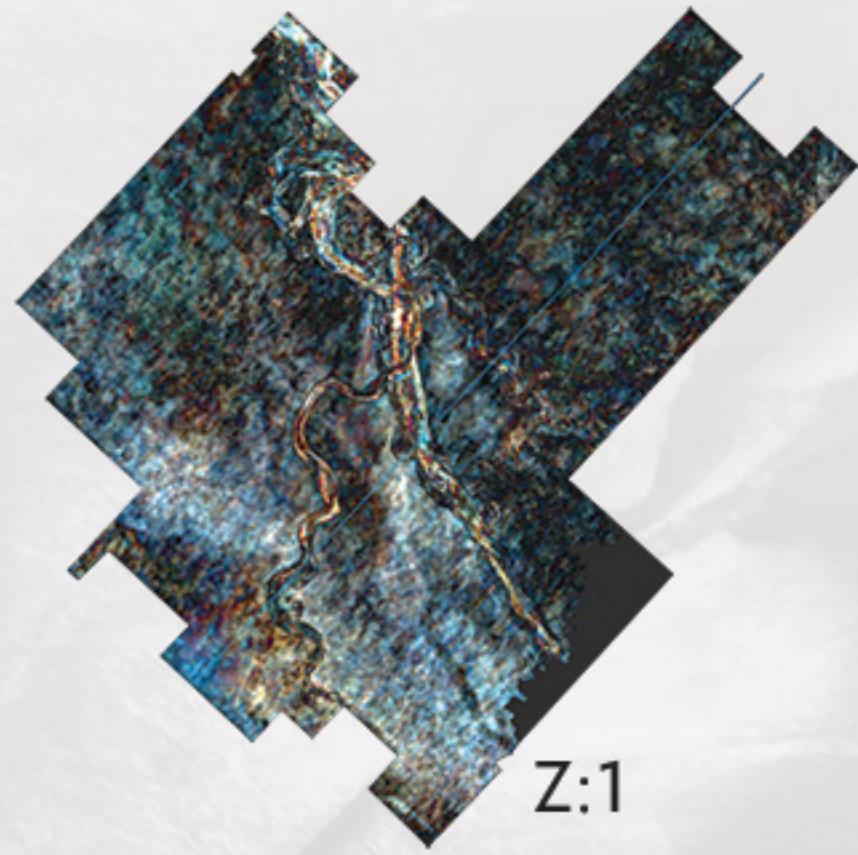
The vast range of attributes, including Spectral and Frequency decomposition, and the excellent color blending functionality make high quality and fast attribute analysis to better visualize geological bodies from large scale source-to-sink systems to reservoir scale features. Save time and effort on focusing more on integrating your knowledge and understanding your depositional history.



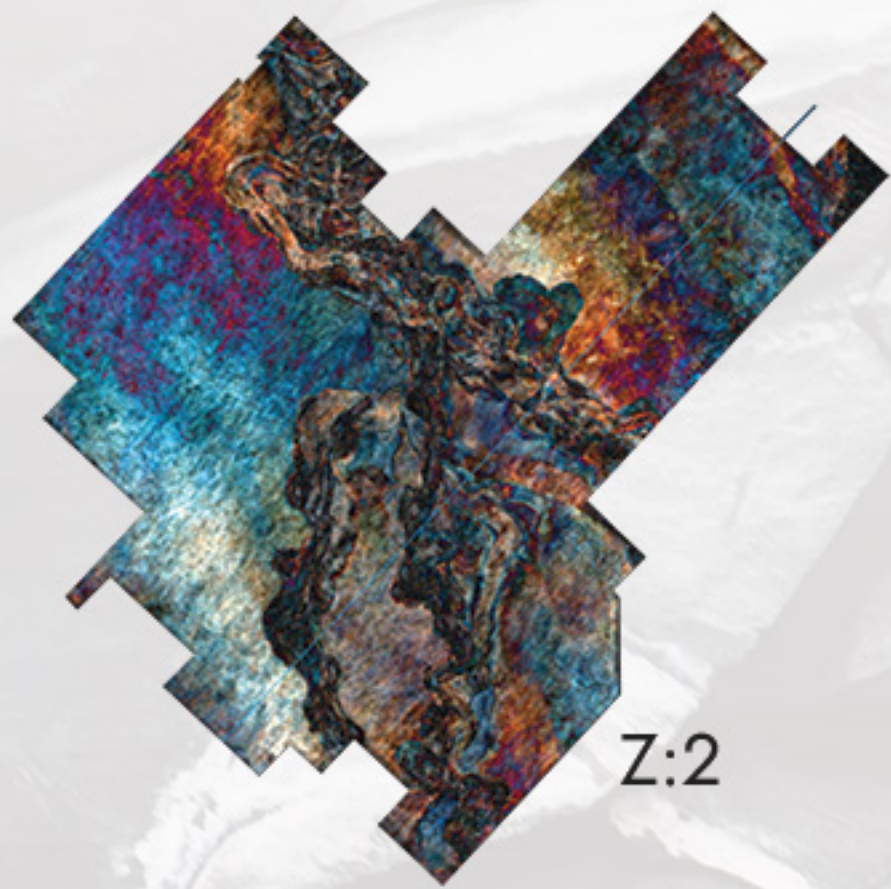
Stratal slicing



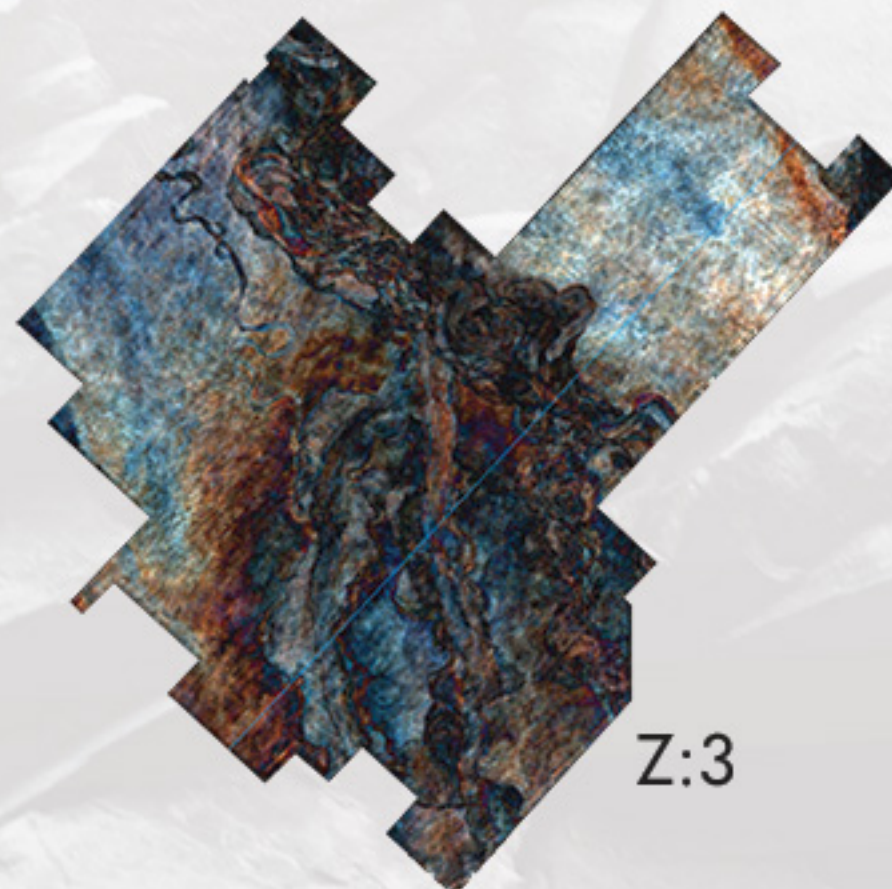
Horizon stack



Z:1



Z:2



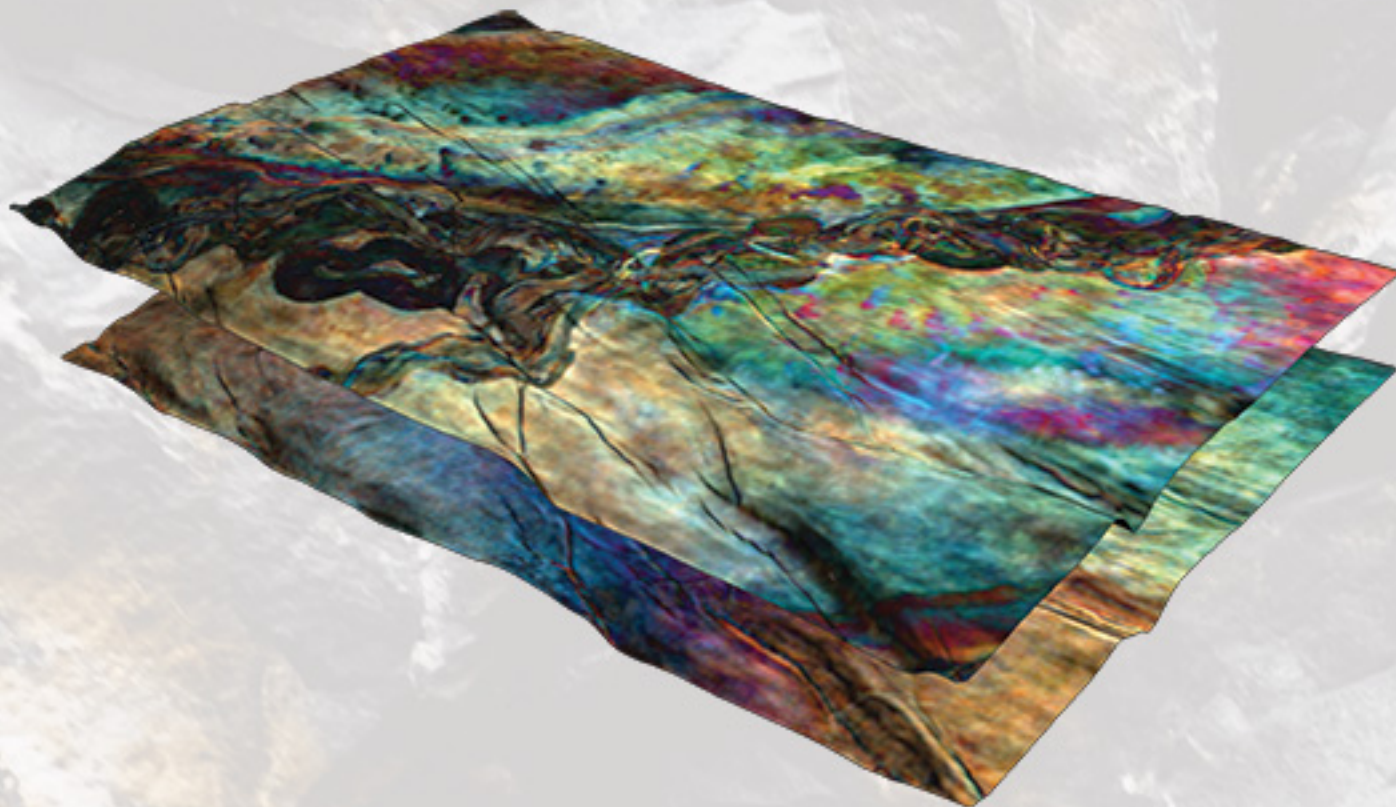
Z:3

Spectral Decomposition

Decompose your image in 2 or 3 different channels and play around with the contrast. Choose the blending method to meet your needs (attribute derived from seismic, RGT, frequency or spectral analysis). Emphasize seismic signatures, delineate and extract them as geobodies.

Various blending methods including

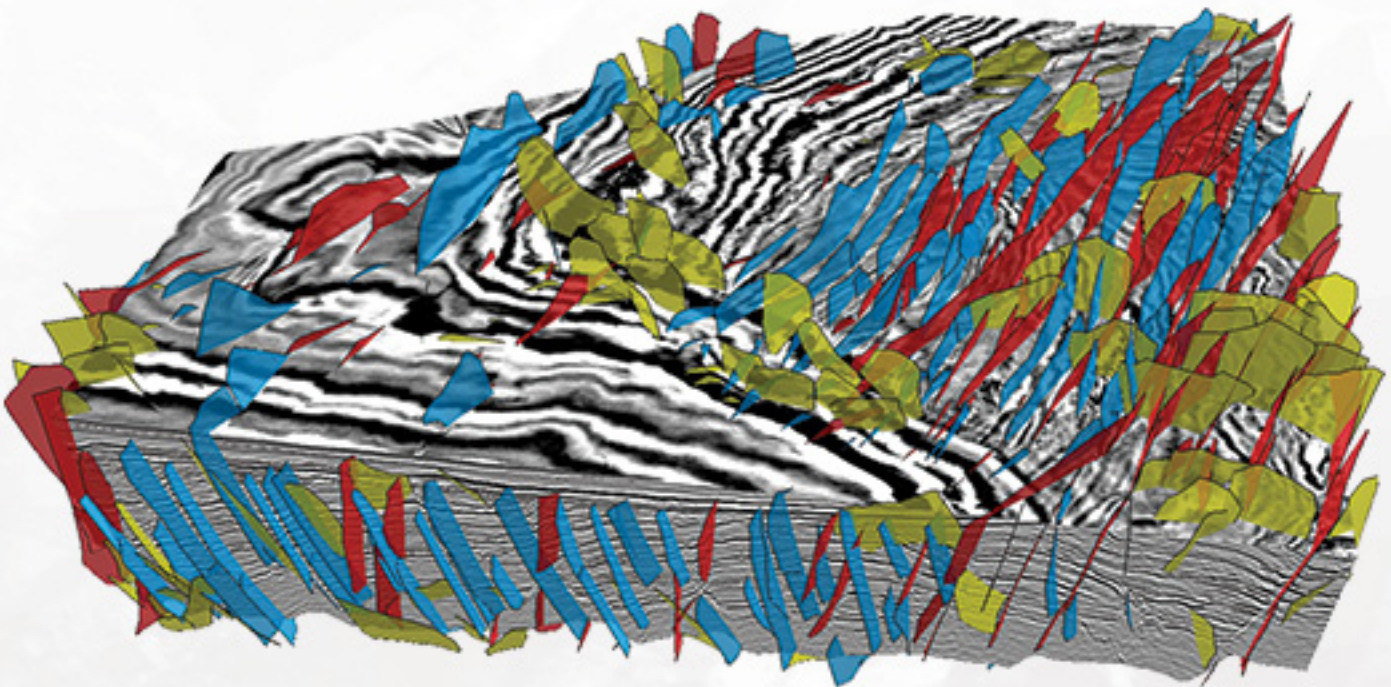
- ▲ Alpha blending
- ▲ RGB (Red, Green, Blue),
- ▲ CMY (Cyan, Magenta, Yellow),
- ▲ HSV (Hue, Saturation, Value),
- ▲ HSL (Hue, Saturation, Lightness)



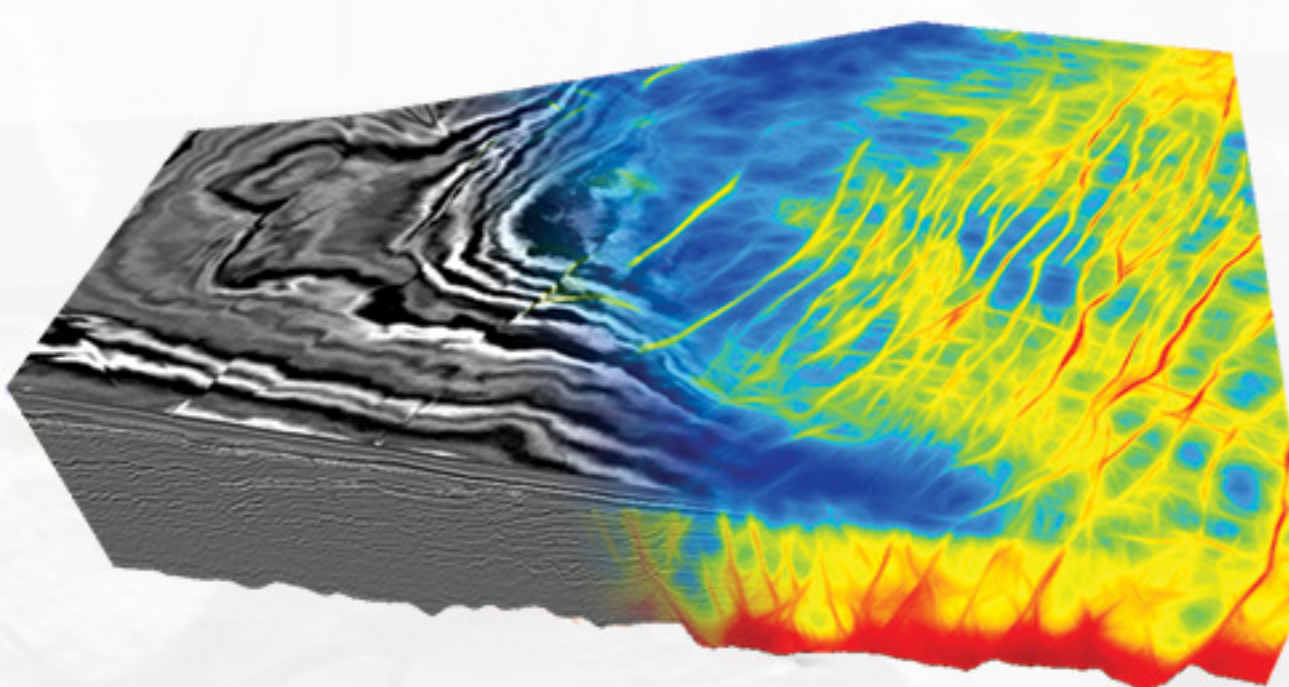
Automated Structural interpretation

Build your structural framework at the speed of a blink!

Handling dense and complex fault networks is at your fingertips with our incredibly fast and hands-on **Automated Fault Extraction (AFE)** workflow.



Fault sets classification



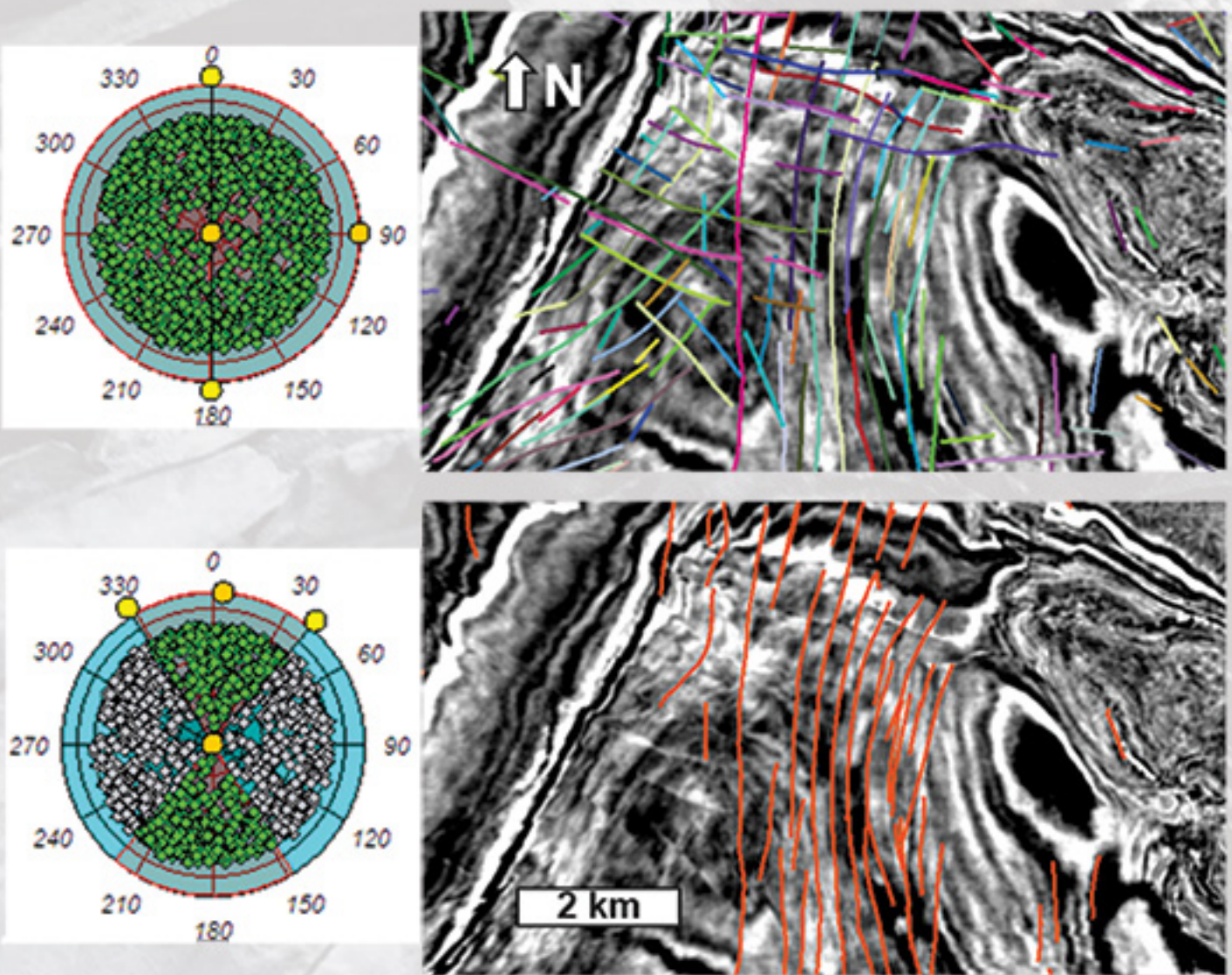
Fault detection through thinning attribute

Our innovative solution proposes an optimized computation of variance values at a given voxel location using different scanning orientations (dip/azimuth) to automatically extract set of faults from a seismic volume. PaleoScan™'s technology gives you the control to investigate and identify optimal parameter settings every step of the way!

Fault management tools such as **Fault Merge Assistant** and **dip/azimuth filtering stereonet** are tremendously useful to speed up the interpretation time and extraction of meaningful and valuable fault sets. The resulted extracted faults can then be used to optimally constrain the **RGT model** and the **Geocellular grid**.

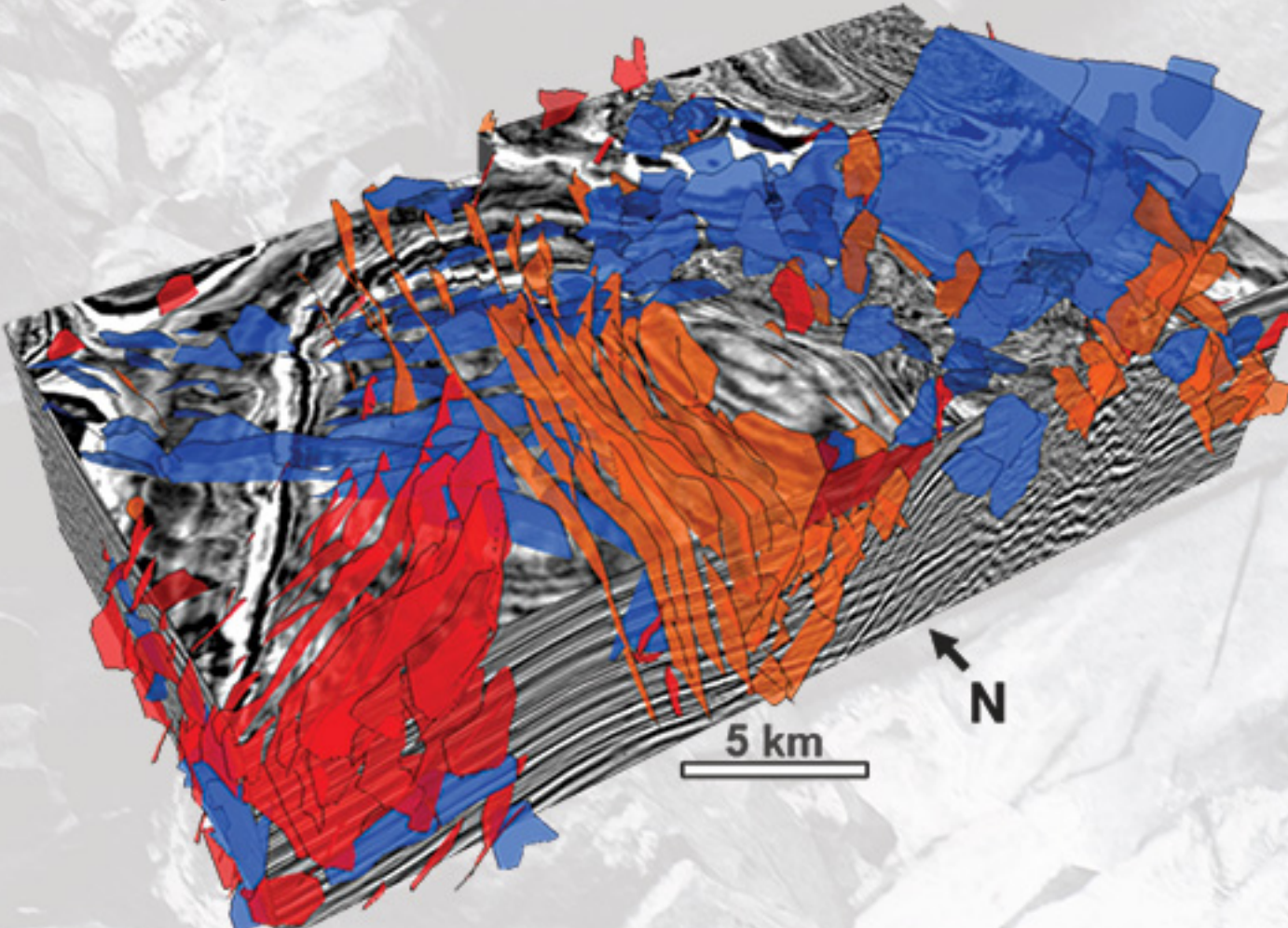
Sealing mechanisms and fault geomechanical properties are crucial information in prospect evaluation and productivity enhancement and can be preliminary assessed through our **Fault throw attribute** and **Allan diagram tool**.

- ▲ Fault plane attribute
- ▲ Automated fault patch extraction
- ▲ Interactive editing
- ▲ Fault patch merge and split
- ▲ Fault merging assistant tool
- ▲ Stereonet filtering



Families of faults can be defined in real time according to:

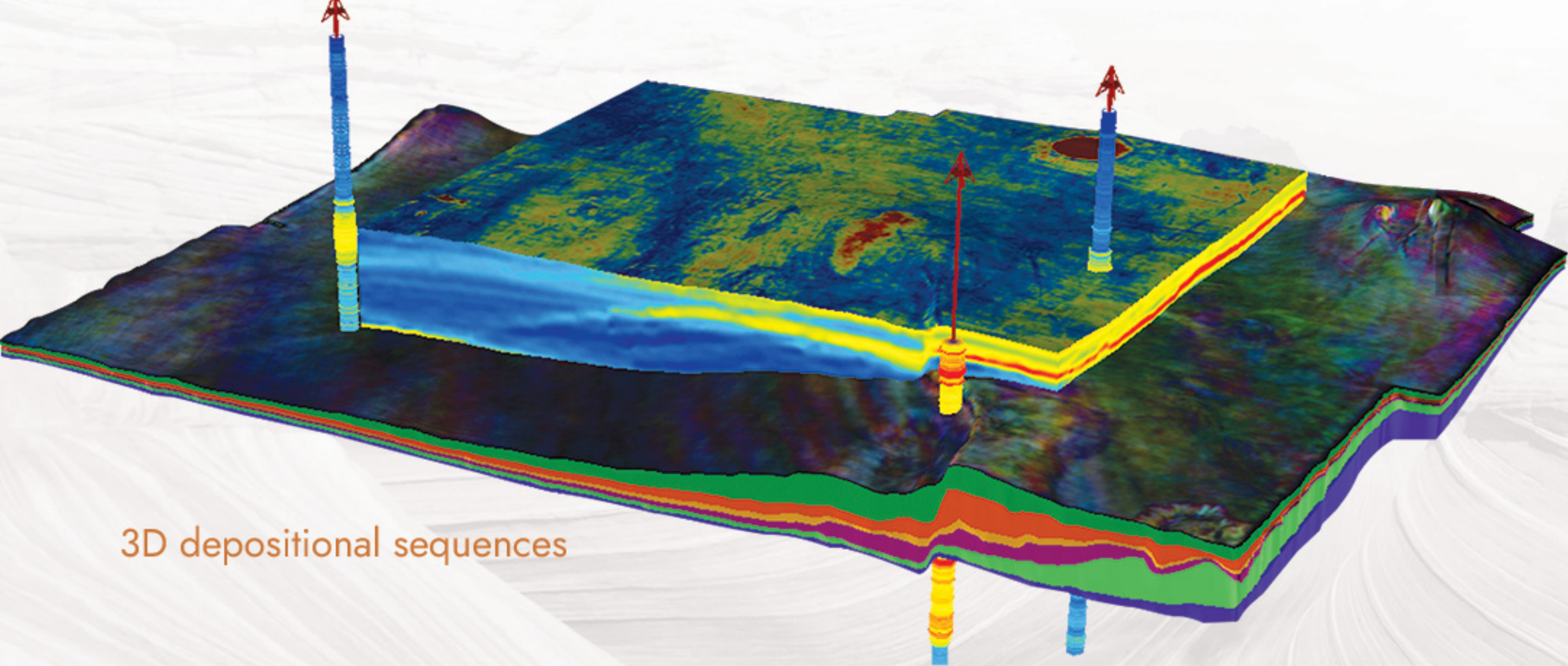
- Size
- Azimuth
- Dip



Wheeler domain interpretation

Strengthen your 3D chronostratigraphic framework, pinpoint your key stratigraphic surfaces, apprehend the spatial and lateral evolution of your megasequences and their intrinsic depositional environments through our **Seismic Stratigraphy module**.

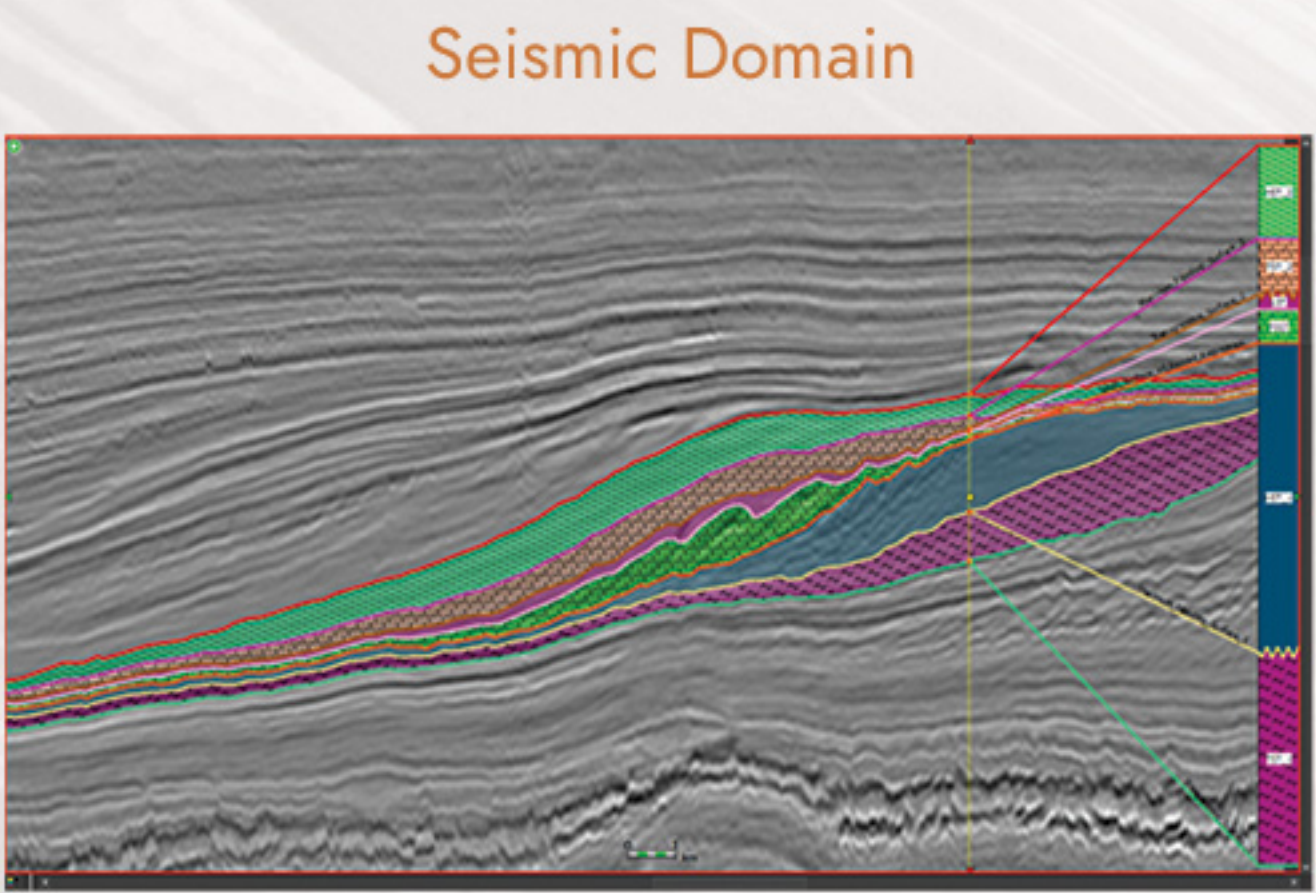
Our **wheeler transform** optimized algorithm allows a direct translation of stacking patterns and systems tracts into relative geological times by flattening the seismic data along chronostratigraphic surfaces. In this way, the sedimentary layers can be considered in terms of base level changes and sedimentation interplay, unconformities and hiatuses, allowing you to be more predictive in locating reservoir, seal and source-rock facies.



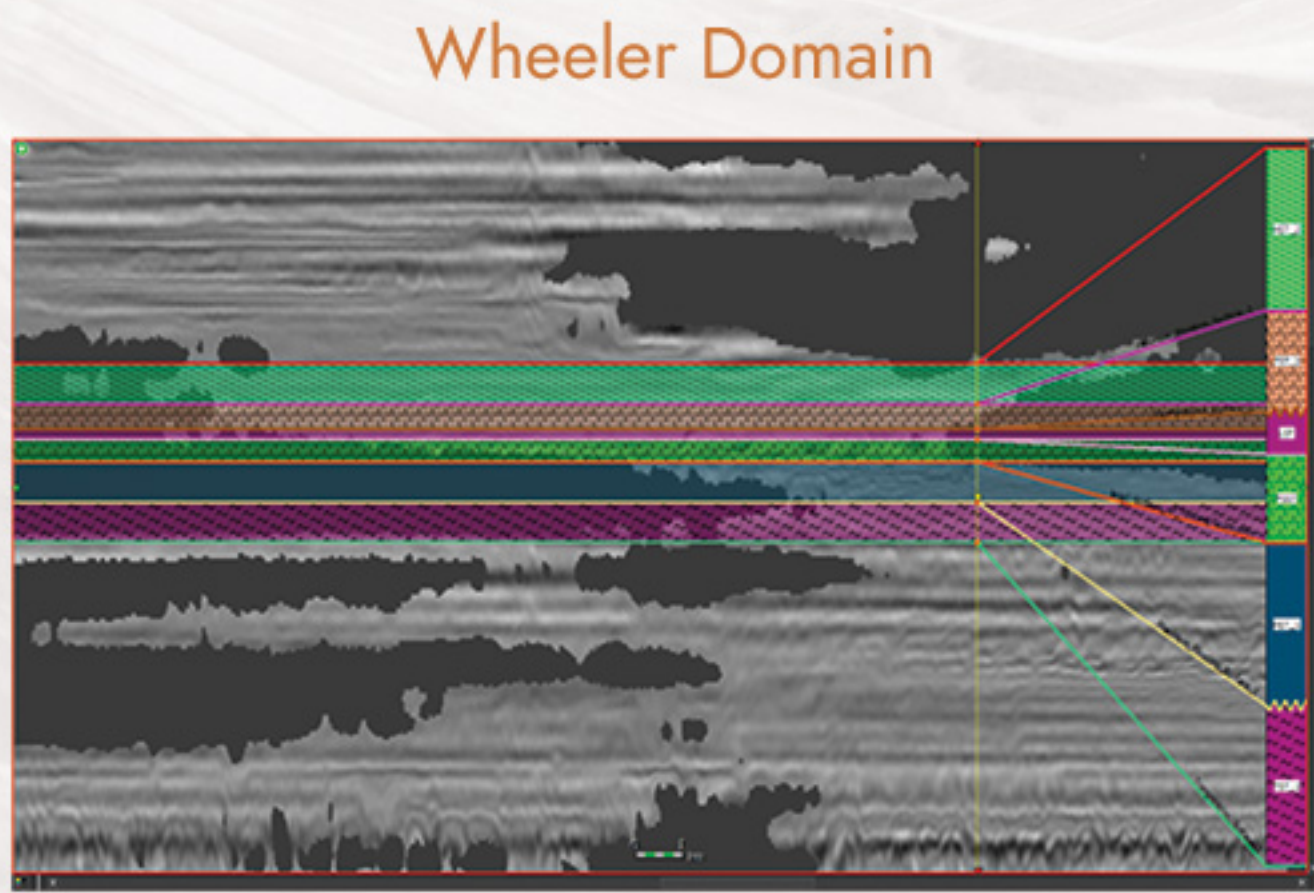
3D depositional sequences

Seismic Stratigraphy module, key elements

- ▲ Generate an interactive Wheeler diagram
- ▲ Highlight depositional sequences
- ▲ Create geological cross-sections
- ▲ Identify unconformity-bounded seismic sequences in 3D
- ▲ Manage surface truncation
- ▲ Create horizon stacks by sequences



Seismic Domain



Wheeler Domain

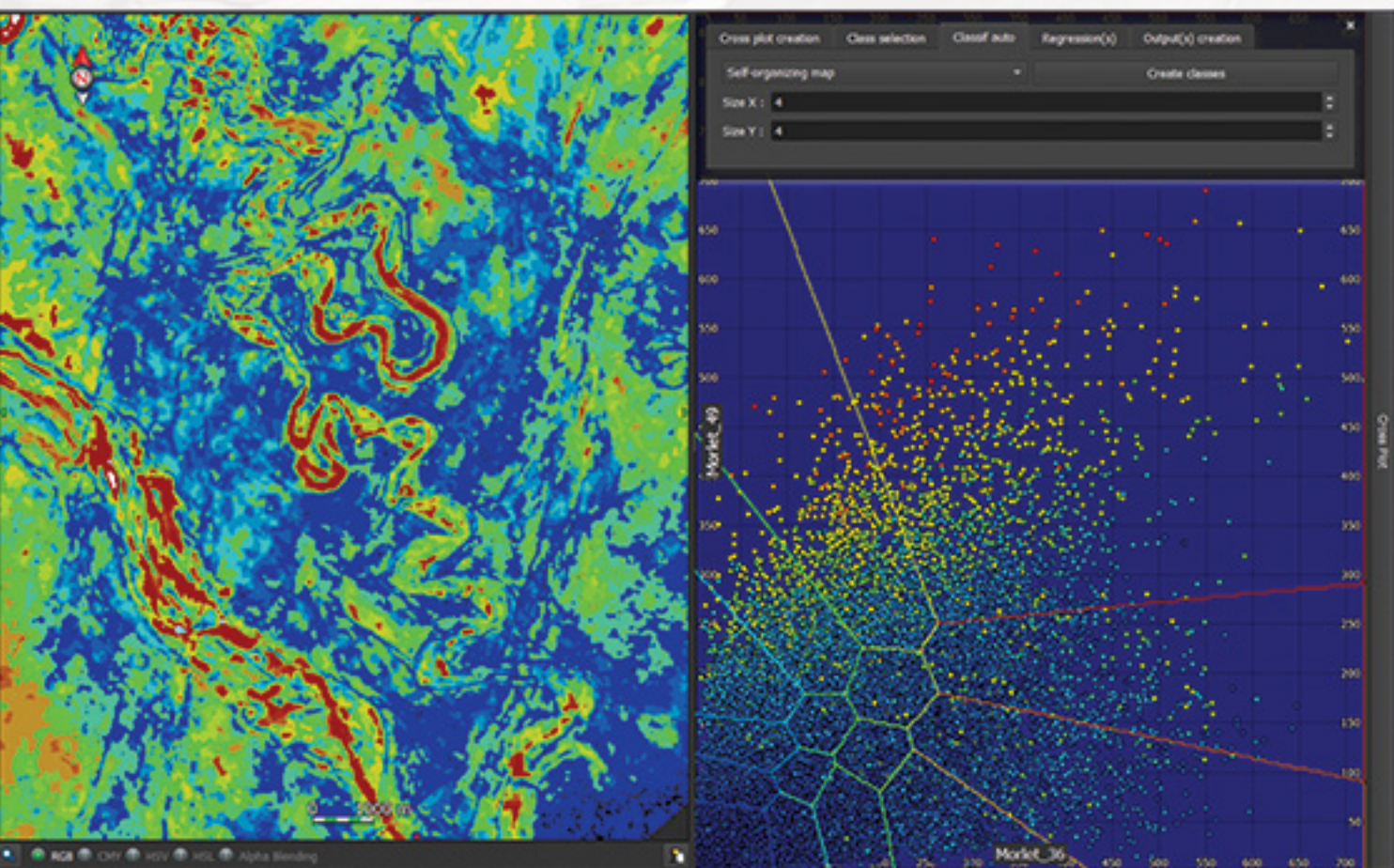
Prospectivity enhancement

Build a robust stratigraphic framework, control and predict your facies distribution and reservoir quality by integrating stratigraphic markers and well log data to your seismic data.

Scan, detect and **extract** 3D geobodies using our seismic facies-based crossplot workflow.

PaleoScan™ provides a toolkit for **visualizing, editing** and **analyzing** well data. Create geological cross-sections, quality check your results and use markers and surfaces to **simultaneously flatten your well correlation panels, cubes and lines**.

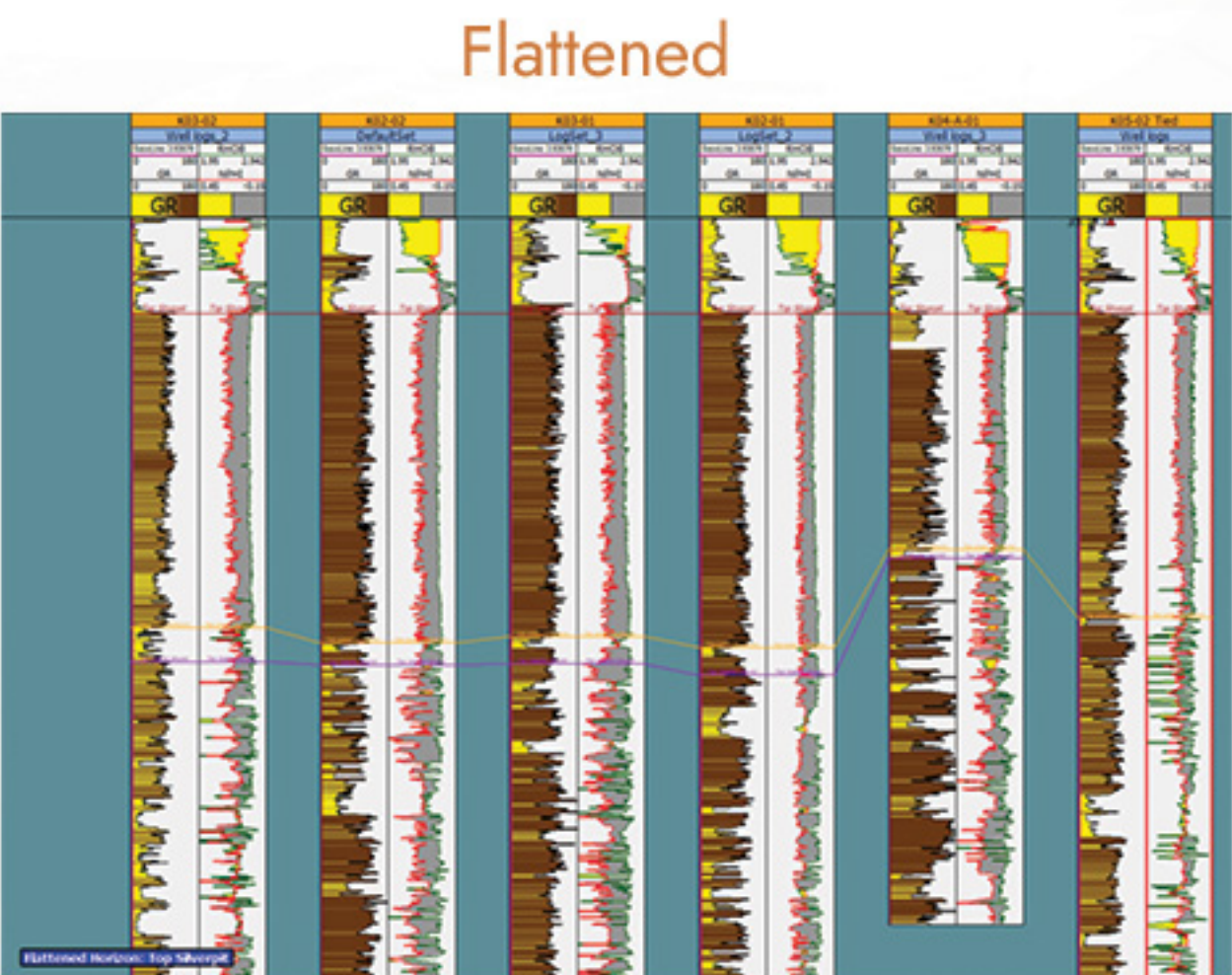
Interactive cross plotting of attributes and well log data is a fundamental tool for lithofacies classification and fluid substitution effects understanding.



Cross-Plot Classification tool

Both manual and automatic classification methods are available to create and organize your lithology or facies classes. By thoroughly and interactively analyzing seismic signatures, you can select a meaningful range of values within your cube and extricate the associated geobodies.

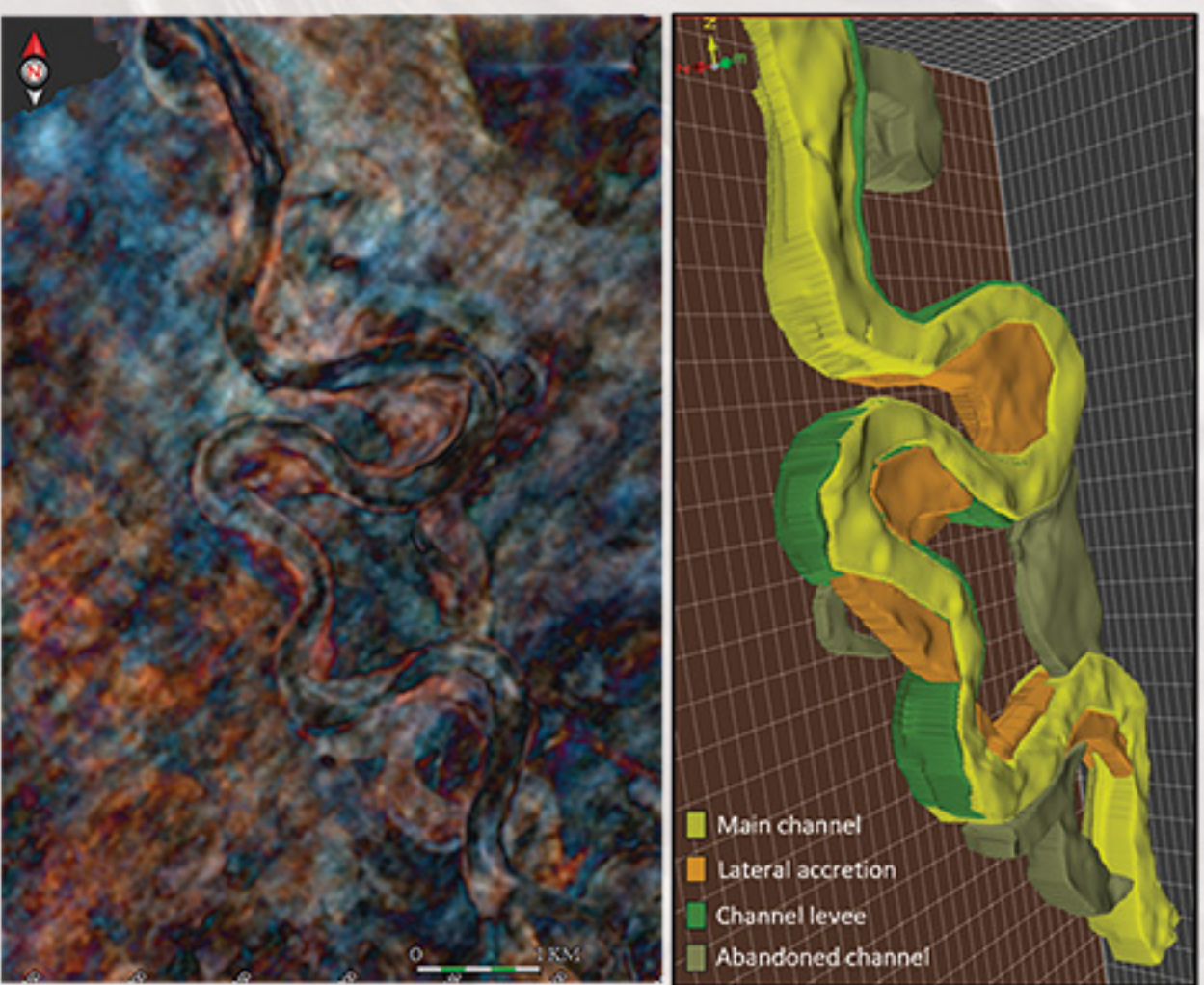
Lithofacies classification performed from well log data results in the creation of **discrete well logs** that can be further used in quantitative reservoir evaluation.



Flattened



Unflattened



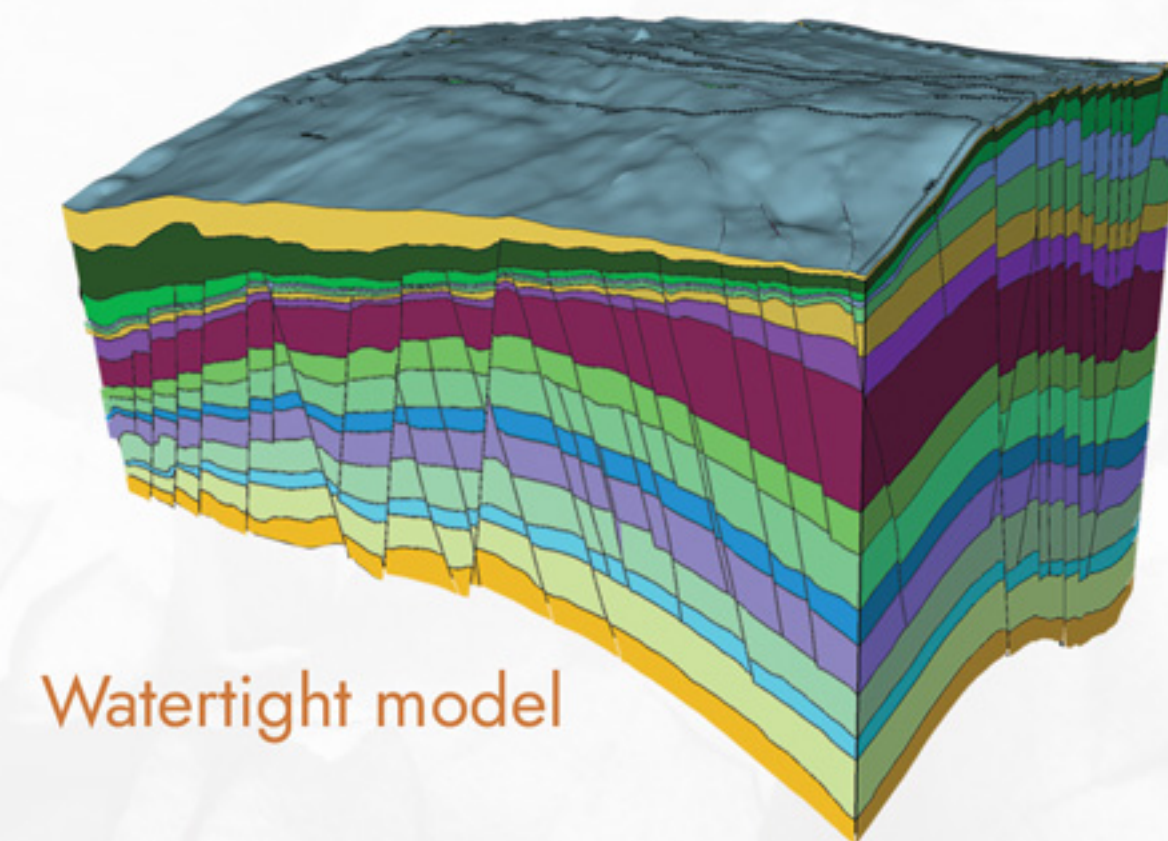
Geobody Extraction

Reservoir Characterization

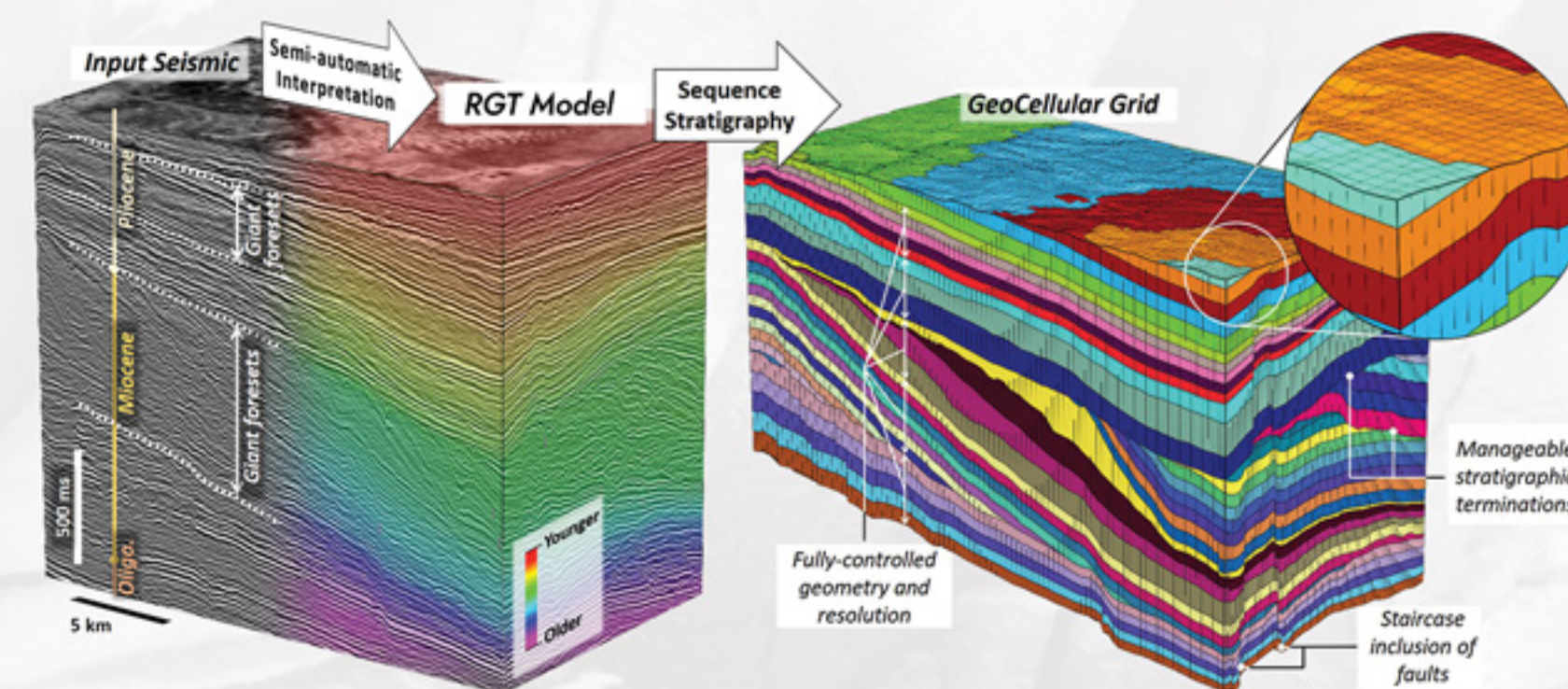
Bridge the gap from seismic interpretation to reservoir modeling by performing an initial assessment of reservoir heterogeneities and petrophysical properties three-dimensional distribution through incorporation of all available information derived from well-log data.

To bring a step-forward structural interpretation, PaleoScan™ offers a unique method to directly generate vector space models from RGT-driven geological layers and fault networks. The newly computed **Watertight model** is then meshed in 3D to obtain sealed fault-surface contacts. These contacts form the basis for fault polygon extraction and layers juxtaposition display within an **Allan diagram**.

Using the same RGT-driven layers and fault networks input combined with stratigraphic termination management and stacking pattern assignment, a **Geocellular grid** can be computed and populated with seismic facies or rock properties. This regular stratigraphic grid of corner point type manages stair-stepped fault modeling.



Watertight model

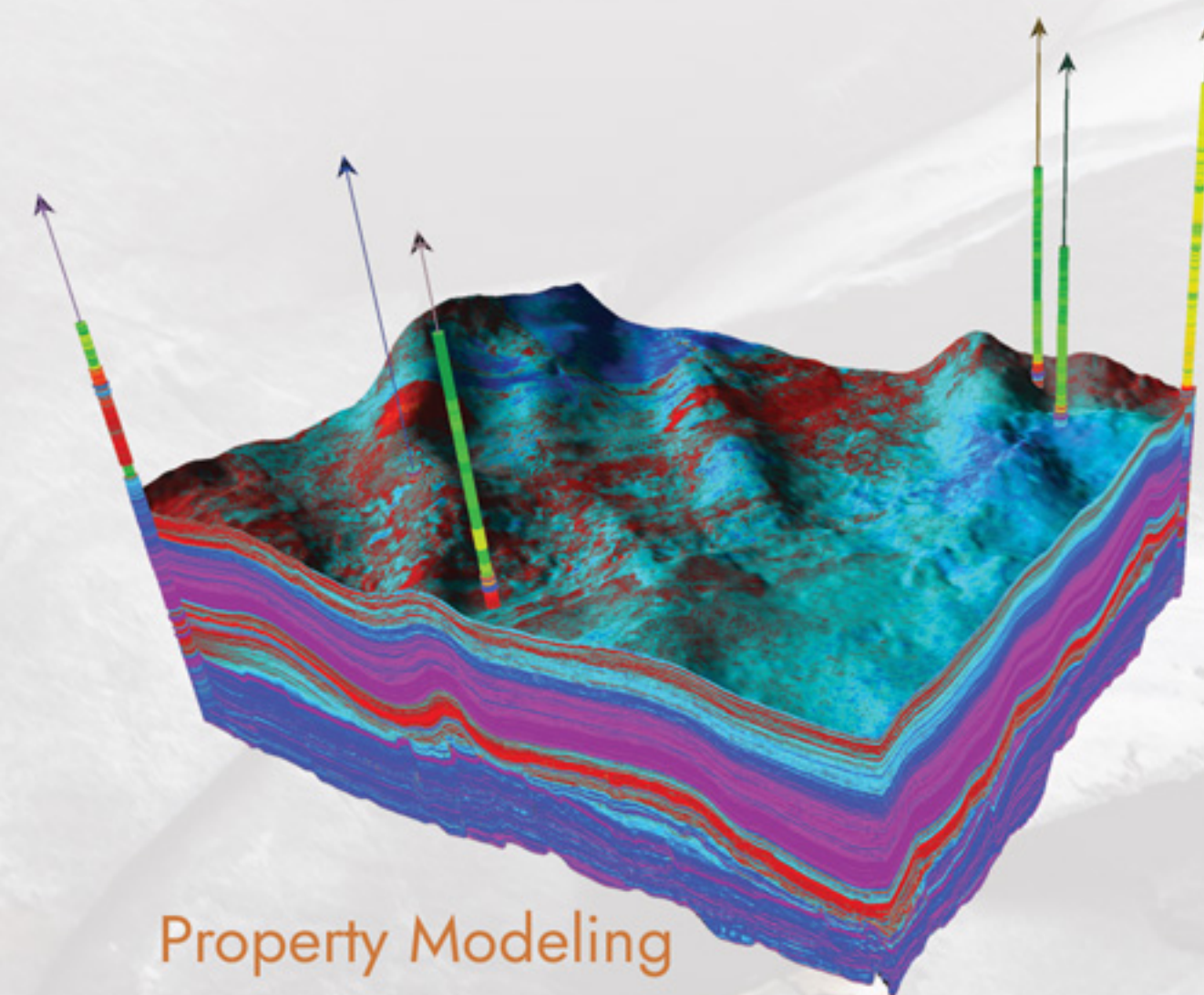


Reservoir Modeling

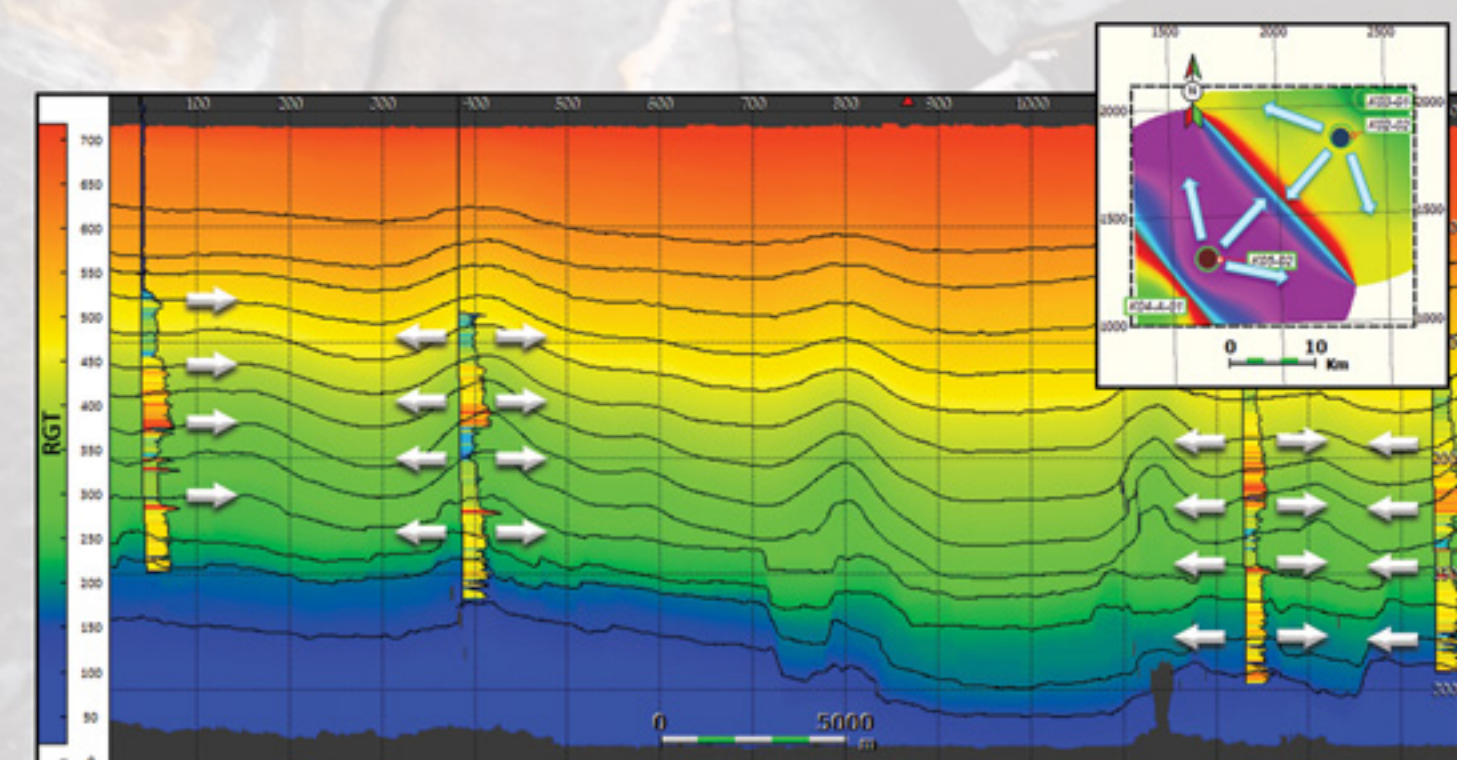
A thorough well analysis from all types of wireline logs achieved by PaleoScan's classification "Cross-plot" tool leads to static reservoir property extraction. Our **Property Modeling** module offers several propagation methods to interpolate between well logs such as inverse distance, kriging and co-kriging which can be visualized in real time on a surface or a cross-section through wells.

One of our signature workflows uses a priori Impedance Acoustic cubes from property modeling to constrain **Colored Inversion** and **Deterministic Inversion** processes. The subsequent results are finally used to populate the Geocellular grid with porosity and fluid content properties.

Propagate well log properties guided by RGT model
Inverse distance, kriging and co-kriging methods
Propagation parameters by stratigraphic sequences
Rock physics distribution prediction
Variograms and anisotropy according to reservoir architecture
Real time preview on horizons and lines along wells



Property Modeling

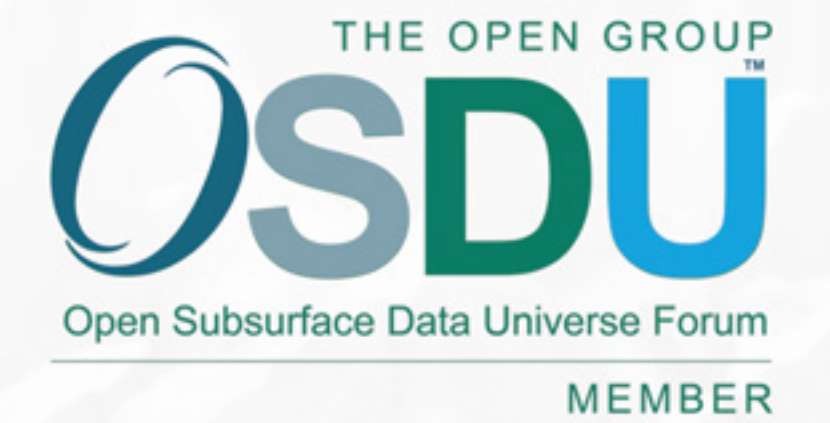


Well log data propagation driven by RGT model

PaleoScan™ conformance journey with OSDU™ Data Platform

Energy companies maintain numerous subsurface applications with local data stores. Consequently, they are burdened with petabytes of difficult to manage, duplicated subsurface data, siloed in proprietary formats that lack data interoperability, leading to additional storage, transfer and conversion costs as well as upstream workflow inefficiency.

In response, The Open Group OSDU™ Forum are developing a standard data platform to reduce silos and put data at the heart of the subsurface community to foster innovation. With the OSDU™ Data Platform, organizations can decouple data from apps and store trusted data unlocking end-to-end workflows.



Eliis is a member of The Open Group OSDU™ Forum since 2020 with the objective to frame PaleoScan™'s evolution to meet to new data standards. The first step of this journey is to guarantee that data can be accessed and delivered directly to PaleoScan™ from the OSDU™ Data Platform using Bluware FAST™ adaptive streaming technology.



Bluware VDS™ is a powerful and flexible storage format for signal data and it has been recognized as the standard of the OSDU™ Data Platform for **seismic storage and exchange**. This format can be stored in two forms including file based and cloud-based object store. It allows you to compress raw and interpreted volumes of seismic data sets. The user can make trade-offs between storage-space and performance based on different compression modes and qualities that can be applied to the signal data, providing a way to make **significant savings in storage space**.

Streaming, rather than copying data, removes local storage needs on traditional file systems and eliminates additional storage costs specific to the import-based workflow. It also centralizes data access and decreases seismic interpretation time cycle by reducing the effort required for data transfer and management. In addition, the object storage system is designed to compress and handle massive libraries of data in an affordable and highly scalable way.

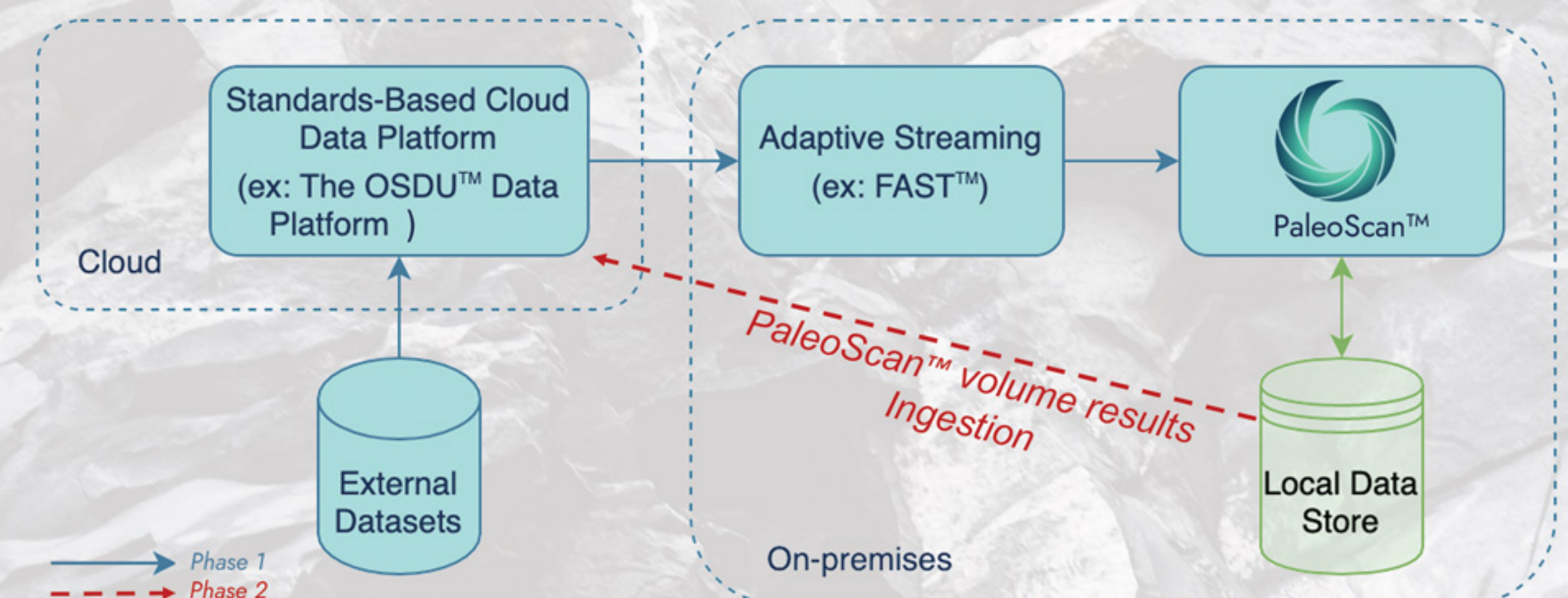
The PaleoScan™ conformance journey with OSDU™ Data Platform will follow these steps:

- Phase 1: Embedding Bluware FAST™ adaptive streaming technology into PaleoScan™.

The integration of **Bluware FAST™** into PaleoScan™ enables the ability to store seismic data in VDS format and stream it from the cloud, leveraging cost-efficient, and highly scalable object storage (AWS S3 or Microsoft Azure BLOB store) to store raw seismic files. Bluware FAST™ acts as a translator between VDS and the read requests made by PaleoScan™. It transcodes from VDS to PaleoScan™ format on-the-fly and stores PaleoScan™ volumes into a virtual drive.

- Phase 2: Export of VDS and ingestion of PaleoScan™ 3D attributes and interpretation volumes into the OSDU™ Data Platform.

- Phase 3: PaleoScan™ reads & writes VDS™ natively to boost overall performance to reduce interpretation time cycle drastically and fit to data standardization & centralization requirements of the energy industry.



VDS™ and FAST™ are trademarks of Bluware

PALEOSCAN™ 2022

Core Application

Platform

Multi 2D and 3D SEG Y import
Faults, horizons, wells and culture data I/O
Data exchange between PaleoScan™ projects
Sessions management
2D viewer and 3D viewer
Volumes blending viewer
Seismic 3D cube visualization
Volume sculpting
Volume stretch, squeeze and rotation
Shapefile management
Point location saving/editing
Geotiff management - Coordinate editor
Volumes orientation
Volumes extraction
Volumes merging
Coordinate reference system management
Unit conversion (feet, meter...)
License timeout

3D Interpretation

3D model grid creation
Model grid between horizons and/or Z values
Semi-automatic horizon interpretation
Interactive model-grid refinement with attribute mapping
Interpretation along arbitrary lines
Smart auto-trackers for manual horizons picking
Horizons propagation and interpolation

2D Interpretation

2D model-grid auto interpretation between lines
2D model grid creation
2D RGT model computation
Multi 2D lines interpretation
2D environment
Misties correction with dynamic shift
Horizons creation from multi 2D lines
Pseudo-3D RGT model computation

3D RGT model

RGT model from model grid
RGT model from marked horizons
RGT model from horizon stack
RGT model from external horizons
RGT model 3D multi-Z

Cross Plot & Classification

Cross plots from volumes, horizons
Cross plots from well logs
Manual and automatic classification (SOM, K-Means)
Regression curves
Retro-mapping and geobodies extraction
Facies volume creation

Geobody & Layer

Geobody modeling
Geobody isochore
Geobody volumetrics
Geobody classification

Faults

Fault plane attribute
Automated fault extraction
Fault dip and azimuth filtering
Fault size filtering
Fault splitting and merging
Fault merging assistant
Fault plane extrapolation
Fault cutting
Seismic ghost

Horizons

Horizon stack creation
Horizon shifting
Horizon merging
Horizon picking along arbitrary lines
Horizon and horizon stack extraction
Horizon lighting
Isochore computation
GRV computation «using 2 threshold»
Horizon extraction using faults polygon
Horizon stack blending viewer
Horizon stack from horizons

Flattening

Horizon flattening
Dynamic flattening from horizon stack
Log viewer flattening
Interpretation flattening

Multi-Z

Multi-Z object picking for 2D and 3D
Multi-Z object editing
Multi-Z smoothing

Attributes

Seismic attributes
Spectral decomposition
Structure oriented smoothing
2D attributes
3D model attributes computation
Real time attributes
Deterministic inversion - New algorithm
Surface real time attributes
Spectral blueing
Colored inversion
Calculator (volumes, horizons, wells, 2D lines)
Volume despiking
AVO post-stack attributes
Extended elastic impedance workflow

Well correlation

Log viewer
Well markers picking
Wells markers management and display
Flattening from well markers
Well marker QC table
Well trajectory picking
Arbitrary line picking
Arbitrary line creation along wells

Add-On Modules

Advanced Interpretation

Sequence Stratigraphy

Sequence creation
Real time wheeler diagram
Sequence along arbitrary lines
Sequence extraction:
- Layers
- Horizons
- Horizons stack
- Isochore
Isochore real time

Color Blending

Volume
Arbitrary line
Horizon stack
Horizon
Color blended volumes export

Automatic Geobody Extraction

Geobody extraction from attributes
Split / merge
Geobody volume computation
Geobody isochore computation

Unconformities Management

Horizons truncations
Terminations selection
Stratigraphic closures

Watertight Model

Horizons / faults
Fault polygons
Allan diagram

Static Geological Model

Corner point grid generation
Stair stepped faults
Seismic facies modeling
Export in Eclipse format
Export in RESQML format

Time-Depth

Seismic-Well Tie

Sonic calibration
Well tie processing
Log depth adjustment
Wavelet creation:
- Analytic
- Statistical
- Deterministic

Velocity Modeling

Layers definition from the model
Interval, average, RMS and Dix velocities
Use interval velocities from the wells

Domain Conversion

Real time conversion
Domain display
- Real time cross navigation

Object saving in depth domain :
- Volumes
- Horizons
- Faults

Property Modeling

Well rock property propagation:
- Inverse distance
- Kriging
- Co-kriging
Sequence integration

Python API

Write and execute Python code in PaleoScan™ :
- Custom seismic attributes
- Custom user interfaces and tools
- Call external code and libraries
- Integration of existing Python libraries (SciPy, NumPy)
- Manipulate main PaleoScan™ objects

Data Connector

Petrel®*

Faults
Horizons
Volumes
Wells
Culture Data
Geobodies - Layers - Multi Z
2D Lines

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OpenWorks®**

3D Volumes
Faults
Horizons
Wells
Well markers

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