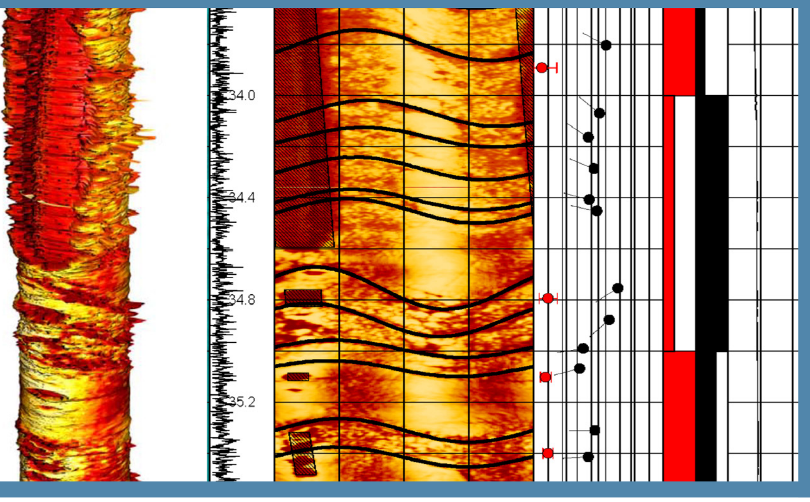
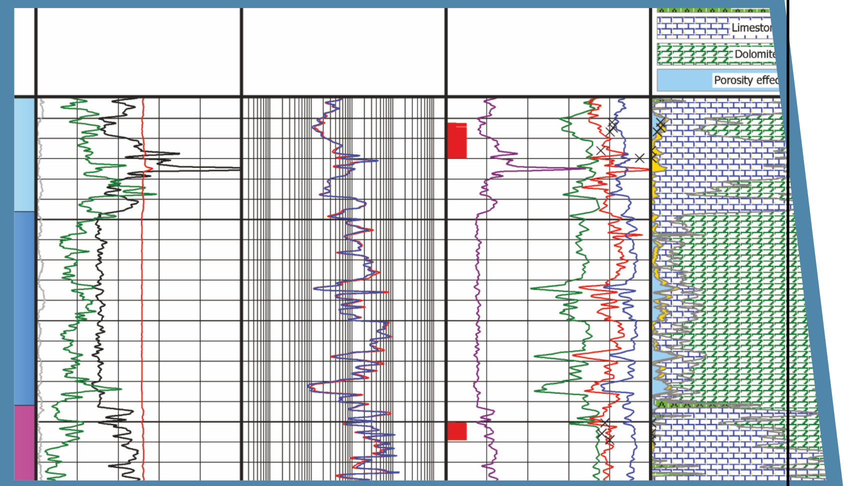
Petrophysics

Reservoir parameters can be determined using well log information and core data. The most common reservoir parameters are porosity, permeability, volume of shale, and thermal conductivity. The used workflows have to be adapted depending on the type of lithology present in the reservoir.

Imagelog Interpretation

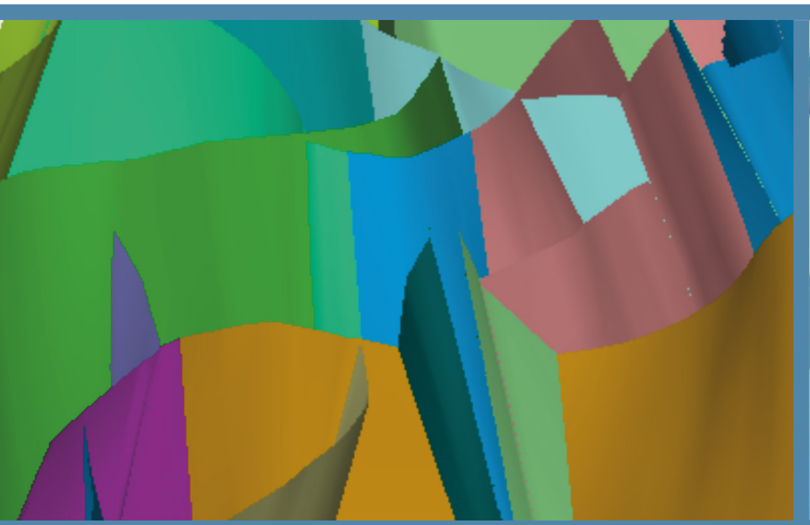
Imagelogs such as FMI or UBI are 2D representations of the bore wall. With the help of imagelogs it is possible to interpret fractures and faults, to determine regional stress directions, and to identify thin beds.

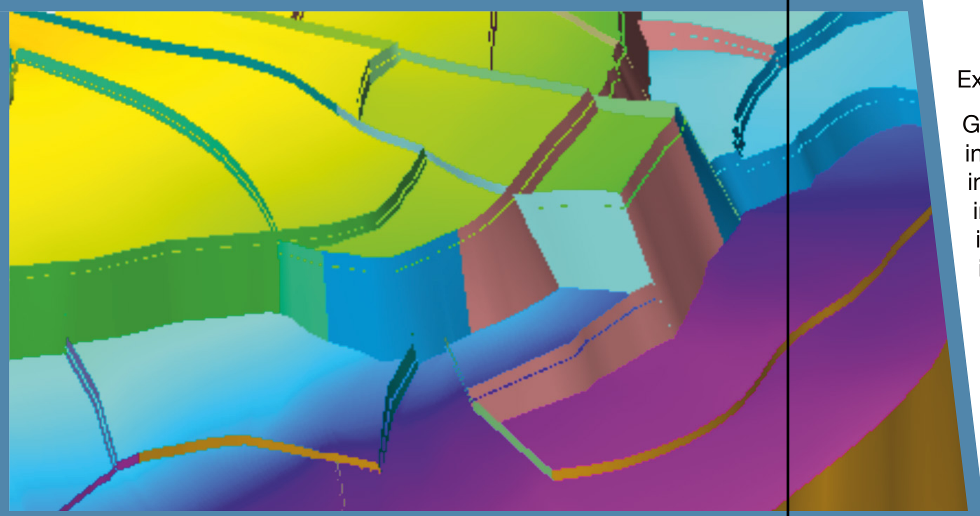




Modeling

The aim of structural modeling is to establish a simplified image of the subsurface. The structural model is the basis for all other modeling processes. Property modeling is the spatial distribution of reservoir parameters like porosity, permeability, water saturation, or volume of shale. The input for the property model is on the one hand petrophysical interpretations, on the other hand seismic attributes that act as trends. The petrophysical interpretations are upscaled into the structural model. In the upscaling process each cell that is penetrated by a well gets one single value for each property. Afterwards, data analysis is performed to derive geostatistical parameters for each property. These geostatistical parameters are then used to spatially distribute the upscaled values. With the help of seismic attributes, it is possible to improve the spatial distribution as they can act as trend properties. A fracture model is a representation of fracture planes that can be used to determine fracture parameters such as fracture porosity and fracture permeability.





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Experience*up to 30 years in the field of:

Geophysical studies for geothermics
in the Styrian Basin
in inner-alpine Basins
in the Molasse Basin
in the Vienna Basin
in the Upper Rhine Graben

Reservoir geophysics studies
in the Sirte Basin (Libya)
in the Murzuq Basin (Libya)
in the Pannonian Basin (Hungary and Romania)

Software Development for OpendTect

* Carried out as JOANNEUM RESEARCH - Institute for Geothermics and Geophysics

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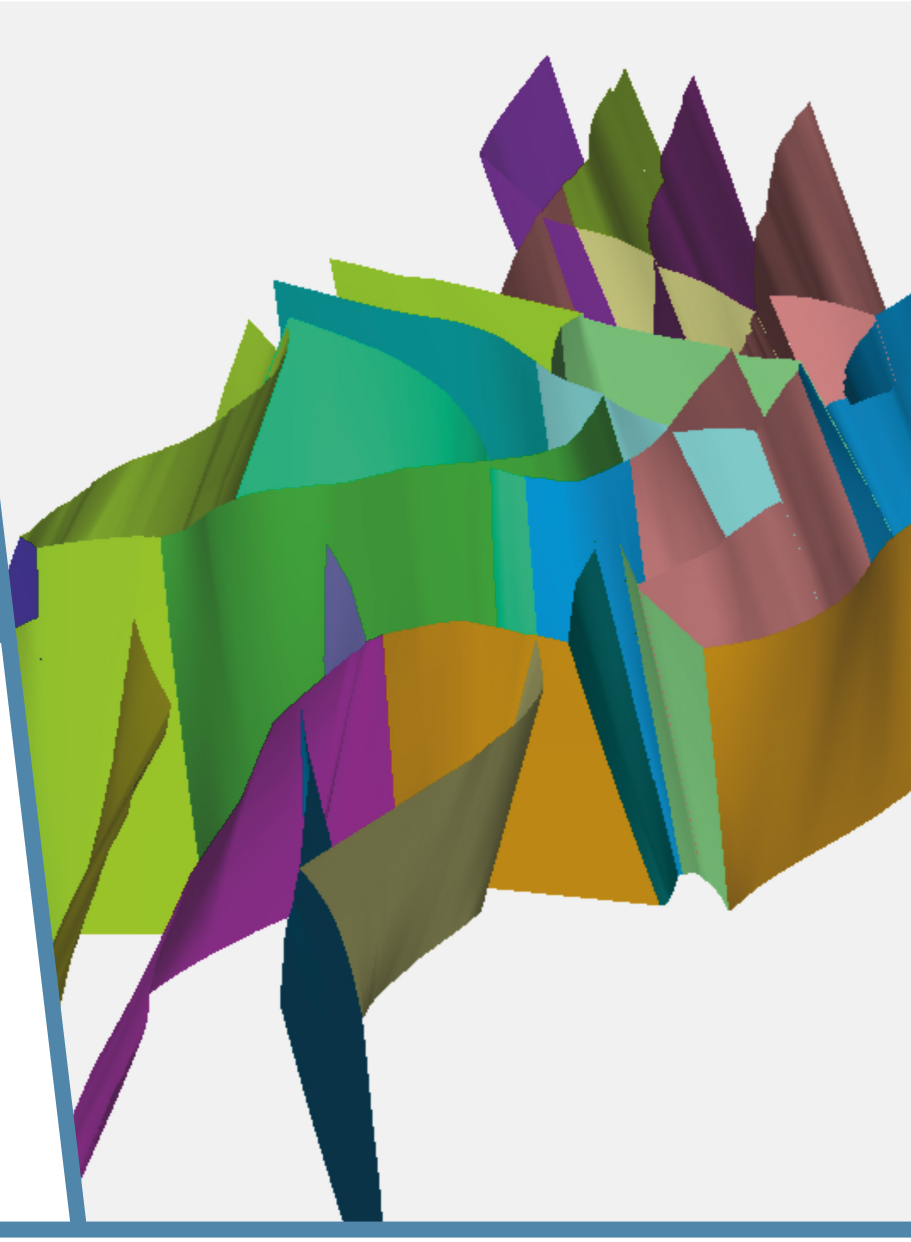

SEISMIC REFLECTION FOR GEOTHERMICS AND RESERVOIR CHARACTERIZATION

ACQUISITION
PROCESSING
INTERPRETATION
SEISMIC ATTRIBUTES
PETROPHYSICS
MODELING

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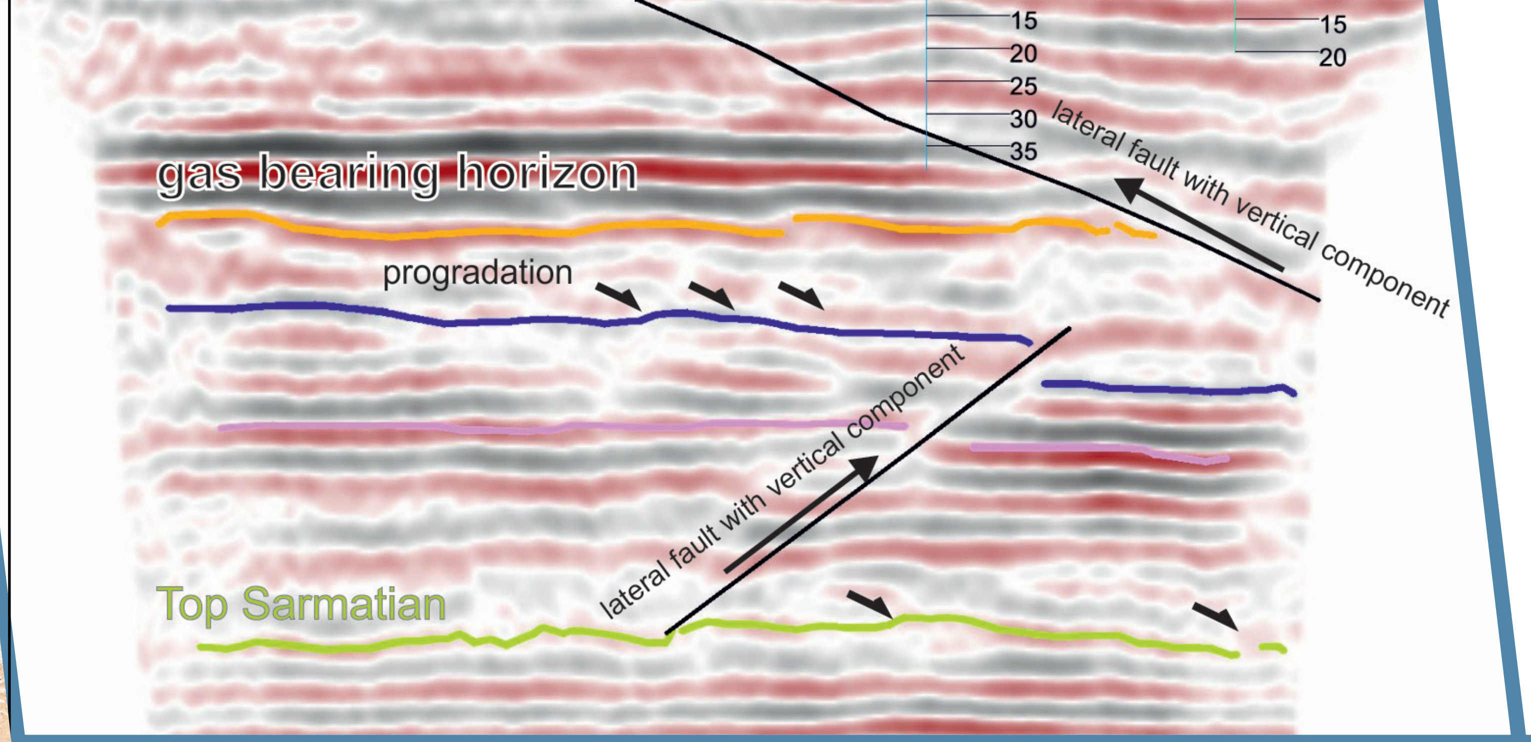
IN-DEPTH EXPERTISE

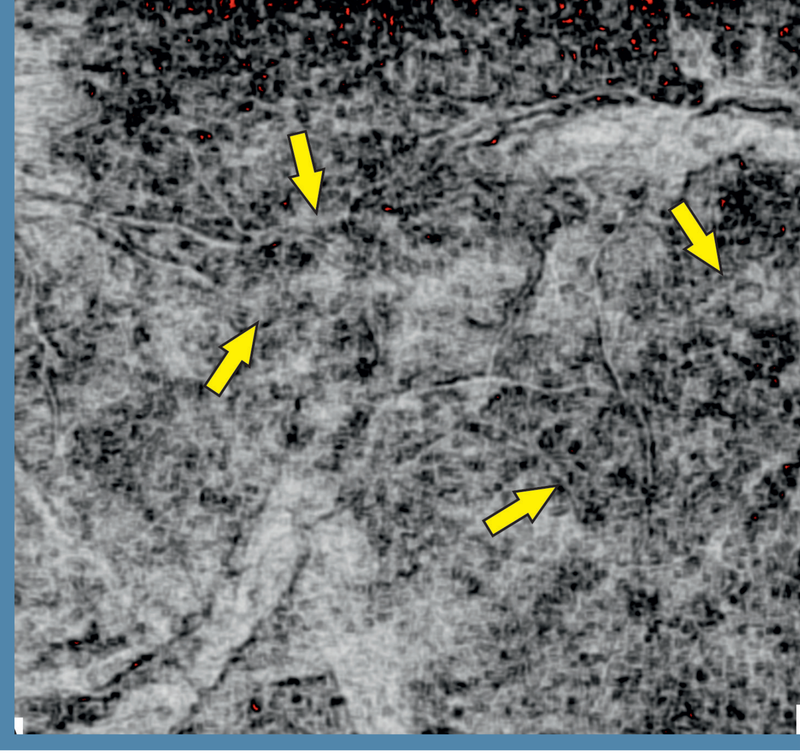
Acquisition

Seismic reflection is based on the propagation of elastic waves. Elastic waves are stimulated artificially by an energy source. The energy source can be dynamite, sledge hammer, mechanic drop weight, or vibrators. Depending on the elastic parameters of the subsurface waves propagate with different velocities. At formation boundaries waves are partly reflected. The reflected wave field is then registered at the surface using geophones and a measuring system. For quality control a field processing is applied.



Seismic Attributes

Seismic attributes are quantities usually extracted or derived from seismic amplitude cubes. These derived attributes enhance the information from the input cube and thus lead to a better visualization and quantization of geological structures, lithologies, and reservoir parameters. Most seismic attributes are calculated from post stack data, but for some attributes (e. g. AVO) it is necessary to use pre stack seismic data. Seismic attribute calculation can be done on single traces or across multiple traces within a predefined analysis window.



Measuring systems:
The staff of Geo5 is engaged in seismic methods for more than 30 years and therefore has gained high experience to several aims under usage of different measuring systems (Geometrics Nimbus; Sercel 338 HR). Currently, the used measuring system is SUMMIT II+

Interpretation

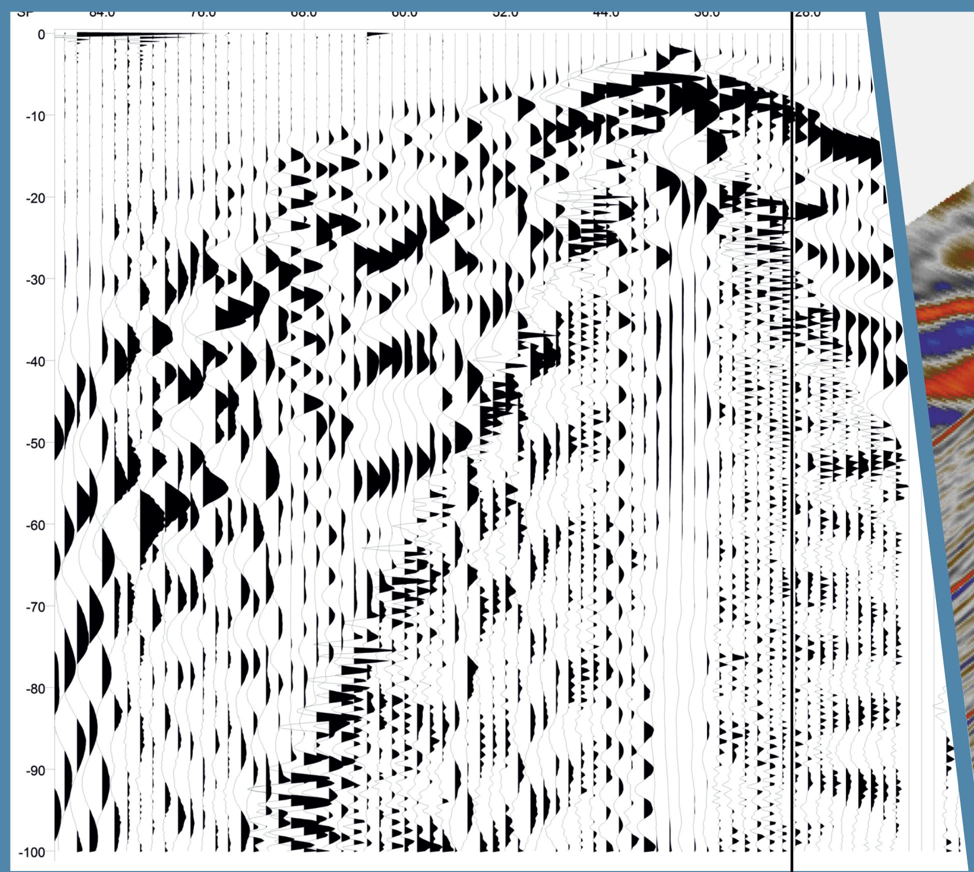
The aim of seismic reflection studies is the visualization of the subsurface (faults, horizons, fractures, karst features, channels) and the generation of a three-dimensional structural model. The interpretation of seismic reflection data can be based on various approaches. The first method is a conventional interpretation of seismic amplitude sections. The second method would be the interpretation of the seismic data using a sequence stratigraphic approach. The third method would be the usage of volumetric seismic attributes. For a detailed description of the subsurface it is necessary to have information from nearby wells (cutting description, checkshot measurements, logs) and to integrate them into the structural interpretation.

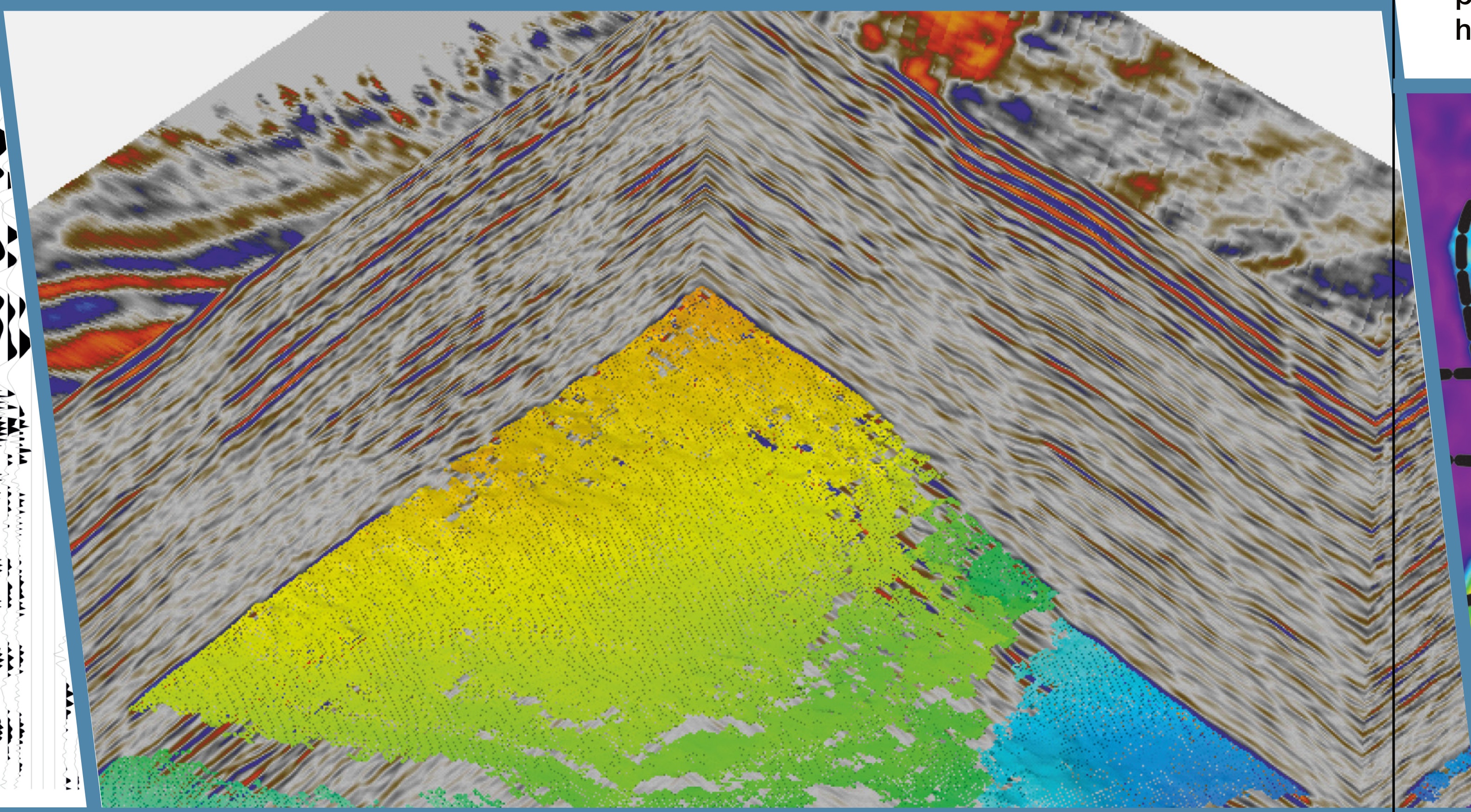
Development of New Seismic Attributes

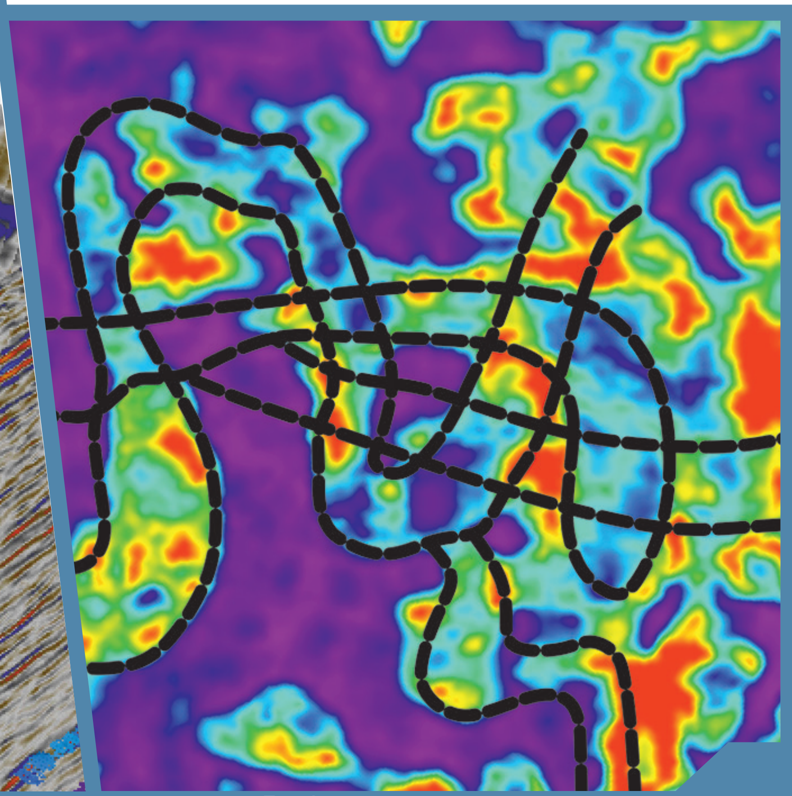
The interpretation of seismic data can be significantly supported by seismic attributes. Common seismic attributes such as coherence, curvature, or spectral decomposition are able to highlight structural features as faults, fractures, or channels. Another approach for an enhanced interpretation would be the application of texture analysis. Texture analysis is a common tool for classification and segmentation of images but has hardly been used for seismic purposes. Over the last decade a few articles has been published about the application of the grey level co-occurrence matrix (GLCM) to image structural features (channels, fractures, facies, ...) on seismic data. The GLCM is a measure of how often different combination of pixel (brightness) values occur in an image. The principal methodology of GLCM calculation is primarily designed for 2D data.
As seismic data can be both 2D and 3D it is necessary to adapt given algorithms for the third dimension. Geo5 programmed a plugin for OpendTect (dGB Earth Sciences) that is capable of calculating 2D and 3D GLCM-based attributes.

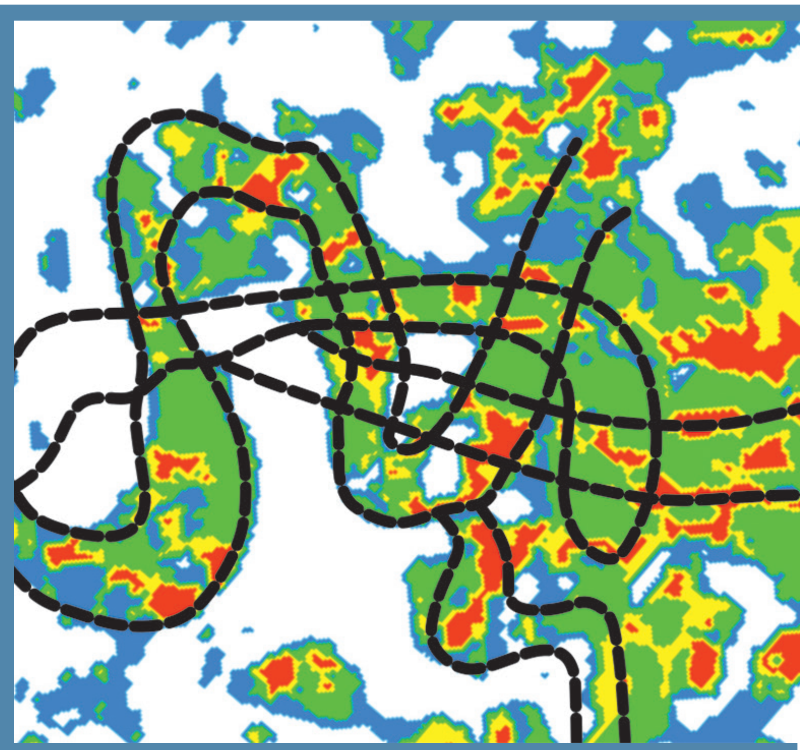
Processing

Processing is the systematic structured preparation of seismic field data for following interpretation. The aim of seismic processing is the increase of signal to noise ratio and the increase of sharpness of the signal (higher frequencies).
In this process care needs to be taken to preserve as much information as possible about the subsurface structure. In the cures of seismic processing subsurface velocities are estimated to generated a stacked seismic. This stacking velocities can also be used in the interpretation process for establishing a time-depth relationship. The result of seismic processing is a final stacked a migrated section.









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