Facies Classification in the Emerson Interpretation Suite

A unique way to gain a deeper understanding of data

The goal of seismic exploration is to build a reservoir model with related properties and to map the intrinsic reservoir heterogeneities. Seismic response depends on the reflectivity of the underlying rocks, and variations observed in the seismic response amplitude are generally interpreted as changes in the depositional environment, lithology and fluid content. Alternatively, the character of seismic data can be analyzed through what is known as seismic facies analysis.

The different classification approaches embedded in the Emerson solution enable:

- Quick and reliable investigation of seismic attributes
- Better understanding of subsurface geological settings
- Delineation and detailed analysis of prospects

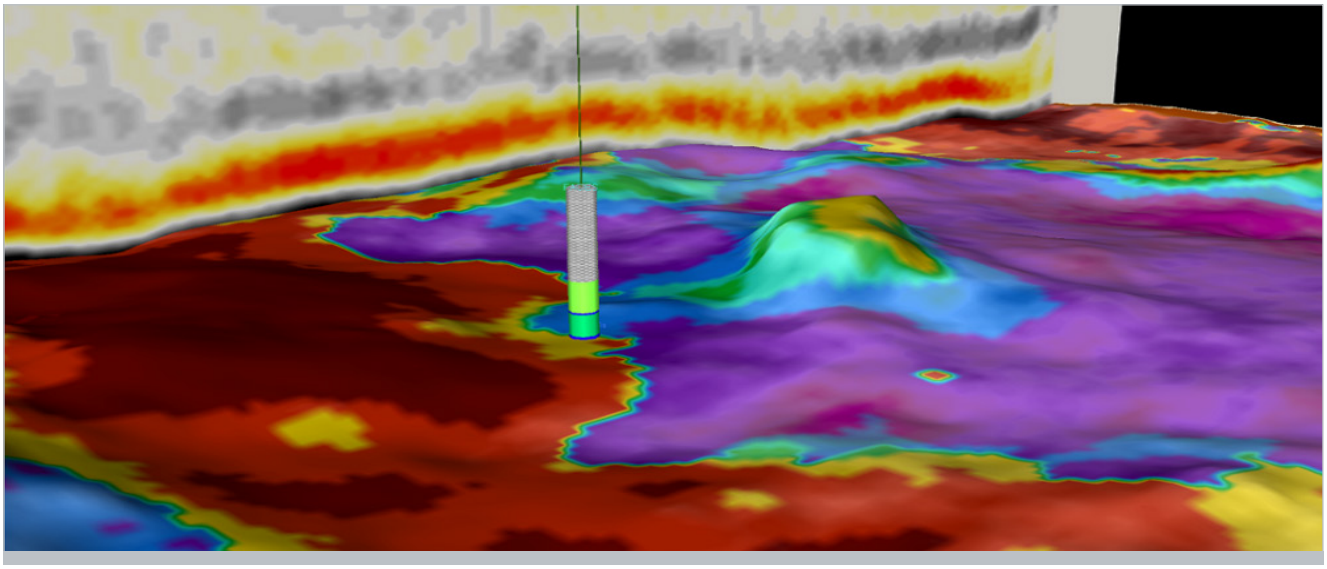
This approach can simply be based on analysis of the seismic waveforms, in order to provide qualitative information about an interval of interest. If mostly used for reservoir characterization purposes, seismic facies classification can be applied in an exploration context, as it provides images (seismic facies maps), related to different depositional facies, that contribute to the characterization of the geological environment and subsurface conditions. However, when operators develop a prospect, more reliable information, such as well logs, becomes available, and it is becoming mandatory to calibrate the facies models to well data.

Emerson offers two different methods for facies-to-well calibration:

- By supervising waveform classification with 2D forward modeling (e.g. wedge)
- By supervising facies volume creation with facies logs

Waveform Classification integration into SeisEarth

Waveform Classification uses the proven Stratimagic™ Neural Network method, known as the most effective unsupervised pattern recognition for automatic identification of seismic facies, based on classifying seismic waveforms. The implementation of this methodology as a plug-in to SeisEarth™ provides access to tools for investigating the seismic data, as well as advanced wave shape constraining from the 2D Modeling utility, to map the impact of changes in reservoir conditions. Geoscientists may map thickness variations or fluid effects on seismic data by constraining the waveform classification with synthetic traces representing those effects. With such an embedded workflow, the geoscientist can perform the calibration of waveform classification to different scenarios, and play the “what if” game to evaluate prospects.



▲ Waveform analysis brings better insight to reservoir lateral extension: Waveform Classification and amplitude blending in SeisEarth 3D Canvas, showing that reservoir zones do not correlate with high amplitudes.

Facies Classification

Rock Type Classification in SeisEarth

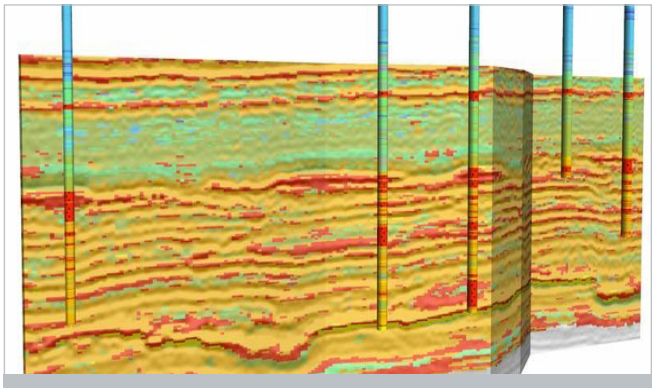
The Rock Type Classification workflow employs an algorithm which generates rock type volumes calibrated to facies logs using a probabilistic approach, to assess uncertainty in rock type quality and distribution. Users have the option to access the Rock Type Classification workflow directly within the interpretation platform. The probabilistic approach results in less guesswork when quantifying uncertainty in rock type distribution. Results are interactively generated in a 2D and 3D environment for in-depth analysis.

Attribute Clustering extends machine learning beyond facies analysis

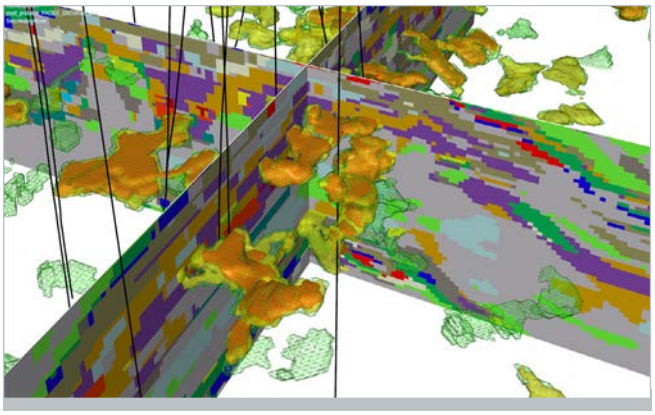
Attribute clustering is a next-generation unsupervised classification method that can be used for facies classification, structural delineation, and AVO analysis by incorporating multiple seismic data sources: prestack, postack and attributes. Outputs include volumes, maps and well logs.

Principal Component Analysis (PCA) extracts information from multiple data sources

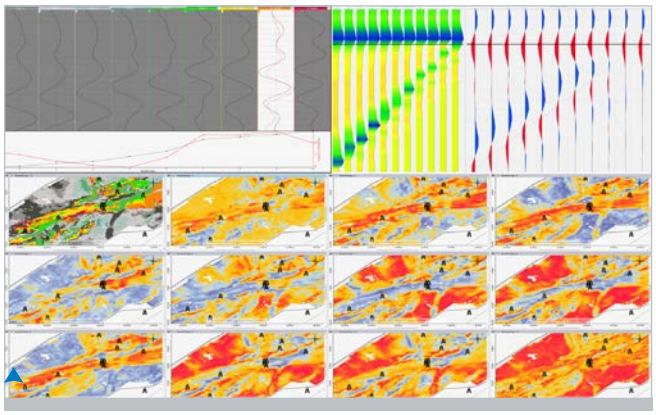
Using a workflow-guided interface, interpreters can perform Principal Component Analysis of seismic data and attributes from multiple data sources, for geological classifications, predictions and anomaly detections (based on Stratimagic functionality).



▲ Rock Type Classification calibrated to wells in a clastic reservoir



▲ Geobodies detected based on good reservoir probability in a carbonate environment. Green - medium, yellow - high, orange – very high probability.



▲ Waveform analysis constrained by wedge model helps highlight tuning zones.

Interoperability

All Epos™-based applications enable interoperability with third-party data stores, including:

- RESQML 2.0.1
- OpenWorks® R5000.10
- GeoFrame® 2012
- Petrel* 2019 & 2018
- Recall™ 5.4.2

(a mark of Schlumberger)*

System specifications

- 64-bit Red Hat® Enterprise Linux® 6.8 and subsequent minor releases, and 7.1 and subsequent minor releases
- Microsoft® Windows® 7, 8.1, 10

The Advantages of Emerson Facies Classification

- Streamlined workflow in the interpretation platform.
- Faster, more accurate calibration between facies volumes and facies logs.
- Increased subsurface meaning of facies results (“connecting the dots”).
- No learning curve thanks to workflow-based approach.
- Interactive validation of parametrization with instantaneous visualization of the results.
- Integration of quality control steps into workflows, promoting data validation within the data generation process.

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