UNIVERSITY of HOUSTON

ALLIED GEOPHYSICAL LABORATORIES

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Degree and Year: Ph.D. Geophysics (4th Year)

Research Interests: Application of multi-attribute analysis to reservoir characterization and time-lapse seismic studies

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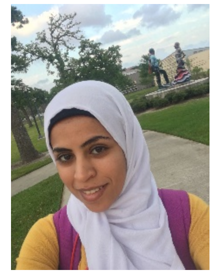
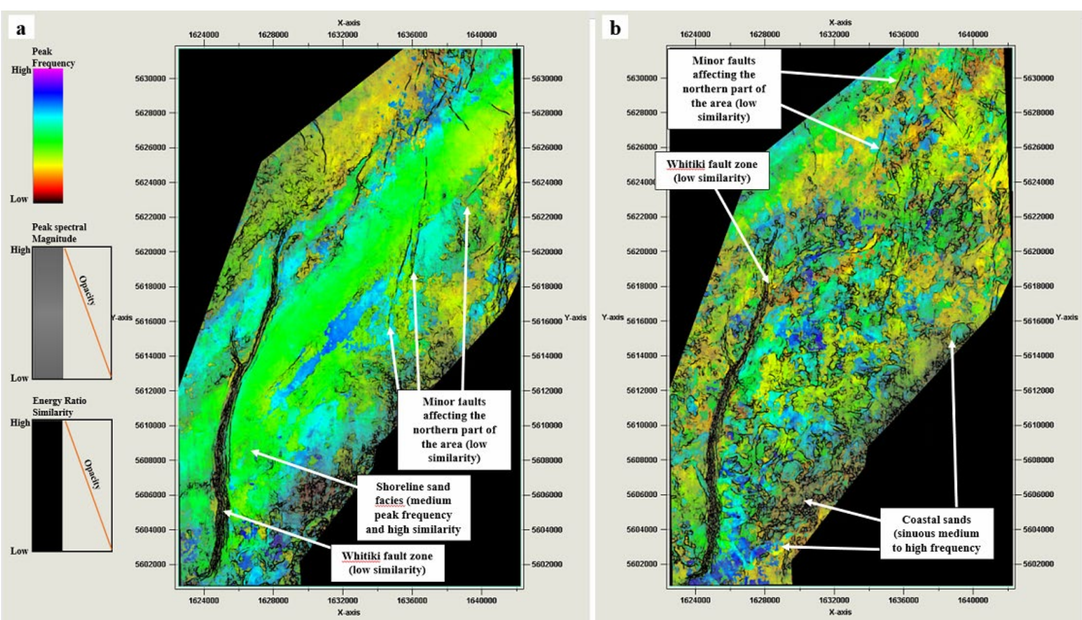


Abstract

Reservoir characterization analysis includes studying the reservoir distribution, identifying its architectural elements, and defining the main structural elements affecting the reservoir. To perform such analysis, the geoscientist has to generate different attribute volumes, investigate vertical and horizontal slices within these volumes, look for specific patterns in the data, and tie these patterns to various litho-facies defined in the well logs, and cores. Over the years, the size and number of seismic attribute volumes (terabyte of data) keep growing in a manner that makes the task of investigating every seismic attribute volume challenging and time-consuming. Computers can be taught to perform specific tasks by using statistical techniques called Machine learning. There have been many Machine Learning applications that we use in our daily life such as the Google search engine, automated vehicles, etc. We manipulate and co-render different attribute volumes to define the main structural and architectural elements affecting the reservoir. The figure below shows co-rendered peak frequency, peak magnitude and energy ratio similarity volumes that aid in defining the main architectural elements affecting the C_Sand reservoir of Maui field in offshore Taranaki basin, New Zealand. These attribute volumes will be used as an input to machine learning algorithms such as self-organizing map (SOM) to study facies (sand vs. shale) distributions within this reservoir. This approach aids in studying the reservoir charactistics, defining the structural features affecting the reservoir, and identifying the main reservoir architectural elements in a timely manner.



Co-rendered flattened peak frequency, peak spectral magnitude and energy ratio similarity shows a) main structural elements (faults; low similarity linear features) and the main reservoir facies (shoreline sand) of the Upper C_Sand reservoir, and b) the main faults affecting the Lower C_Sand reservoir and architectural elements (coastal sand deposits).

Recently, there has been a great interest in time-lapse seismic studies that aid in defining bypassed oil and improve reservoir production. Defining the reservoir characteristic and monitoring the fluid movements in a timely manner is critical for time-lapse projects. Ongoing research focuses on the application of multi-attribute analysis and machine learning to reservoir characterization analysis. We are also planning to test the unsupervised machine learning (SOM) to the time-lapse seismic data of Maui field to monitor fluid-movements. In addition, supervised machine learning (deep learning) will be tested on this time-lapse seismic data and well logs to monitor water saturation changes due to reservoir production.