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Adapting Seismic Methodologies for use in Acoustic Logging

Ley, Shreya B.; Biswas, Partha
GeoBiz Technology, Inc.; GeoBiz Technology, Inc.

Summary

Our research focused on providing an update to acoustic logging processing methods for use in unconventional wells and for the best and most effective use of modern toolsets.

Introduction

If we are to continue to use acoustic logging as a viable method for identifying natural fractures in the well bore, then logging techniques developed for conventional reservoirs and vertical wells should be updated and adapted for use in today's unconventional and directional drilling applications. Unlike seismic processes, which have undergone research and changes to adapt to the more difficult characterization needs of today's wells, acoustic logging techniques have stayed relatively stagnant. The following discussion focuses on four seismic techniques GeoBiz Technology has adapted for acoustic logging processes.

Theory and/or Method

We have based new acoustic logging algorithms and routines on these four seismic techniques and adapted the research into new, proprietary software, for processing acoustic waveform data. The four seismic methods adapted are the following:

- We have adapted the use of compressional waves to map drops in energy across natural fractures which allows to move away from many of the limitations imposed by more widely used techniques in acoustic logging interpretation.
- We have incorporated predicted deconvolution for increased noise reduction to enhance the ability to confidently process acoustic data from measurement-while-drilling or logging-while-drilling tools.
- We have adapted stacking to improve results and amplify anomalies.
- Lastly, we have adapted the use of flexural waves in computing azimuth to move away from Alford so that borehole deviation does not adversely affect the computations.

Examples

The use of compressional waves to map natural fracture patterns has found great success in both vertical and lateral wells and has been used in the field in the Permian, Eagle Ford, the Bakken, and in varying international fields. Comparisons against image and core results demonstrate at least an 80-85% correlation rate. The following discussion will go over two case studies, briefly discuss the workflow used, and also provide an example of how the predicted deconvolution routine produces much cleaner waveforms for processing than frequency filtered waveforms.

Conclusions

These new processes allow acoustic processing to enter the modern age of exploration and create a new, more direct process for finding the fracture density in the well bore. Furthermore, they stand to adapt all processing techniques to effectively utilize the modern tools available.

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