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Keynote Presentation - Microseismic Data Integration: How Connecting the Dots can Help Solve the Unconventionals Puzzle

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SUMMARY

Unconventional reservoirs are generally developed using hydraulic fracturing. Having a good understanding of the hydraulic fracture characteristics helps in optimally and efficiently developing the reservoir. Microseismic monitoring has proven to be a valuable technique to monitor hydraulic fracturing operations. During the hydraulic fracture treatment fluid is injected in the reservoir and cracks form, which results in the occurrence of microseismic events. The monitoring and interpretation of this microseismic events can lead to a better understanding of the hydraulic fracture characteristics. Microseismic monitoring of hydraulic fracturing is generally used to assess the fracture parameters like hydraulic fracture height, length, orientation, and complexity. However, it is a challenge to retrieve information like effective (producing) fracture parameters and hydraulic fracturing efficiency. Besides, the value of information from microseismic would become larger when it can be used to go beyond retrospective analysis, and can help to facilitate the prediction of the hydraulic fracture behavior. In order to solve this unconventional puzzle and to maximize the learnings from microseismic data, it is required to evaluate this microseismic data along with other sources of data.

Introduction

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Method and/or Theory

Generally micro-seismic data is acquired within a larger data acquisition campaign. The goal of such an operation is to get a better understanding of the hydraulic fracture treatment and the resulting production. Figure 1 shows an example of different data sources that can be acquired and combined for an integrated data evaluation. For example, when combining microseismic with reflection seismic, the fracture containment can be analyzed and even predicted (Figure 2). Additionally, when the reflection seismic is converted into physically meaningful parameters by seismic inversion we can use this information for sweetspotting of production and fraccability. Furthermore, by merging microseismic with data like Distributed Acoustic Sensing (DAS) the completion efficiency can be evaluated, and the hydraulic versus the effective fracture parameters can be unraveled [1].

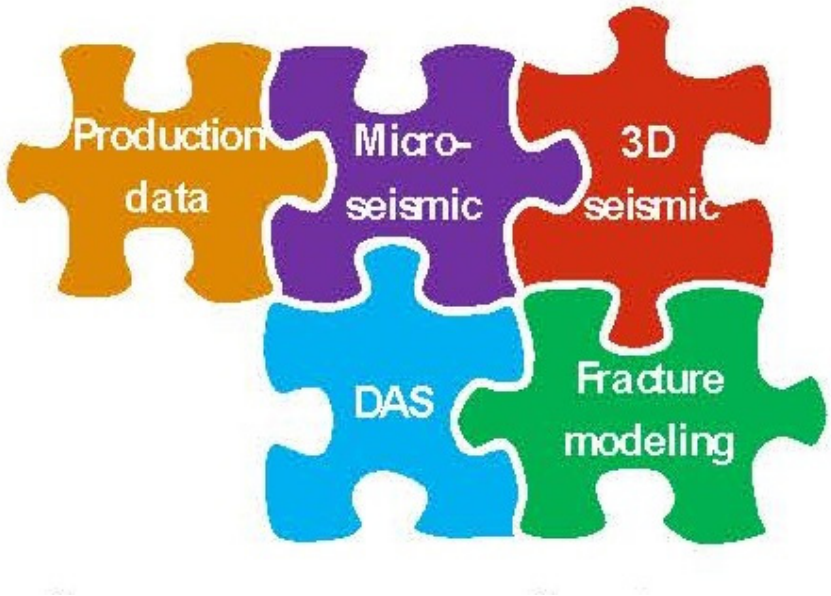

Figure 1 *Cartoon of microseismic data integration to solve the unconventionals puzzle.*

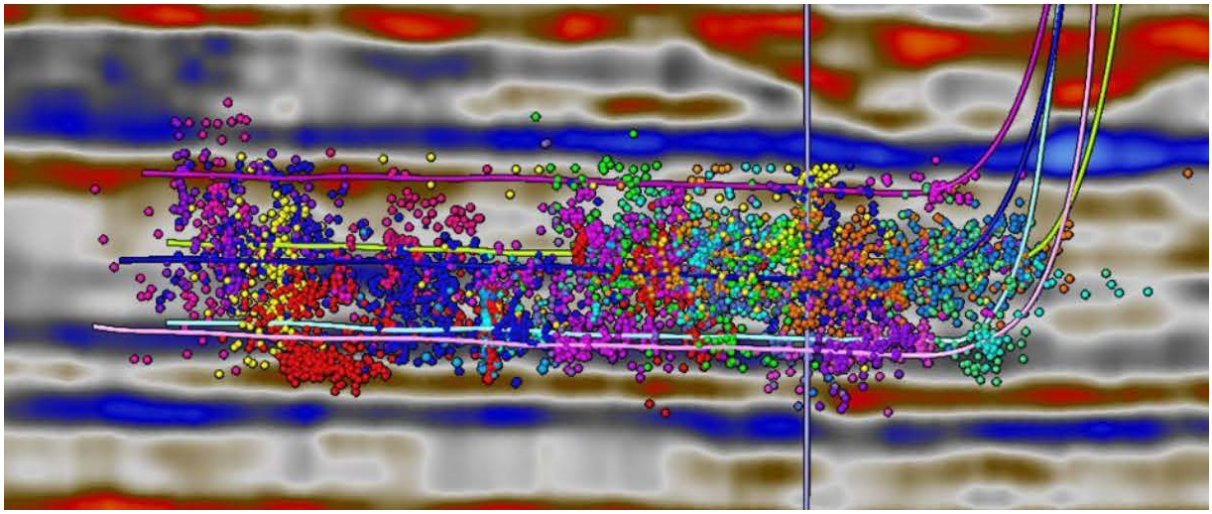

Figure 2 *Example of integrated analysis of microseismic data (coloured dots) and 3D inverted seismic data (red-gray-blue background) to learn about hydraulic fracture behaviour.*

Conclusions

The final goal of microseismic data integration is to get a full understanding of how hydraulic fractures behave in order to solve the unconventionals puzzle.

References

[1] Developments in Diagnostic Tools for Hydraulic Fracture Geometry Analysis. Paul Webster, Barbara Cox, Mathieu Molenaar Unconventional Resources Technology Conference, Denver, Colorado, 12-14 August 2013: 218-224.