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# High Resolution Velocity Attribute for Reservoirs, Lithology and Pore Pressure Prediction

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## Summary

A high resolution (HighRes) velocity attribute has been developed to support geological interpretation of velocity data. Inversion of seismic processing velocities can be used to predict lithology, porosity, pore pressure and uplift / erosion (Hubred and Meisingset, 2013 and Peikert, 1985). The quality of the Velocity Inversion depends on the type and resolution of the velocity data. The closer the velocity field is to a P-wave of real rock velocity, the more accurate the predictions will be. In this work we show results from inversion of HighRes velocity fields, comparing with conventional seismic processing velocities, with a particular focus on lithology and pore pressure.

## Methods and application

The HighRes velocity attribute was constructed based on two methods: Amplitude Inversion combined with Dynamic Auto Correlation, or combined with Dynamic Time Warping (Øverås et.al, 2018). By combining these two methods the HighRes velocity field can be generated quickly, without big machine computation power. The initial input is seismic stacking velocity and gathers. The technique requires clean gathers, free from low and very high frequency noise and refractions. Therefore, gather preconditioning is necessary. The technique works best with seismic data with a wide range of frequencies, such as in broadband data in general, and in the medium to shallow part of the seismic where a wider range of frequencies are present.

We have tested Velocity Inversion on different types of velocity data including conventionial seismic processing velocities (stacking and migration), FWI and HighRes velocities. The conventional seismic processing velocities give a decent general result but have poor resolution. FWI velocities give good results but are costly and time consuming to produce. HighRes velocities give good general results and have high resolution, and they are efficient to compute. This data type is ideal as input to high resolution Velocity Inversion (Figure 1).

The lithology and pore pressure prediction demonstrated here are based on a Velocity Inversion technique developed by I. Meisingset while at Norsk Hydro ca 1995. This is a technique which defines a physical model for the compaction of sediments and on its base it inverts the data to pseudo lithology, apparent porosity, apparent pore pressure and apparent uplift / erosion. Seismic processing velocities are corrected for anisotropy before inversion.

## Conclusion

In this work we demonstrate HighRes velocity attribute geo exploration. The conducted tests with different velocity types show that a HighRes velocity field is a useful attribute for geological interpretations such as lithology, porosity and pore pressure / geohazard predictions.

## Example

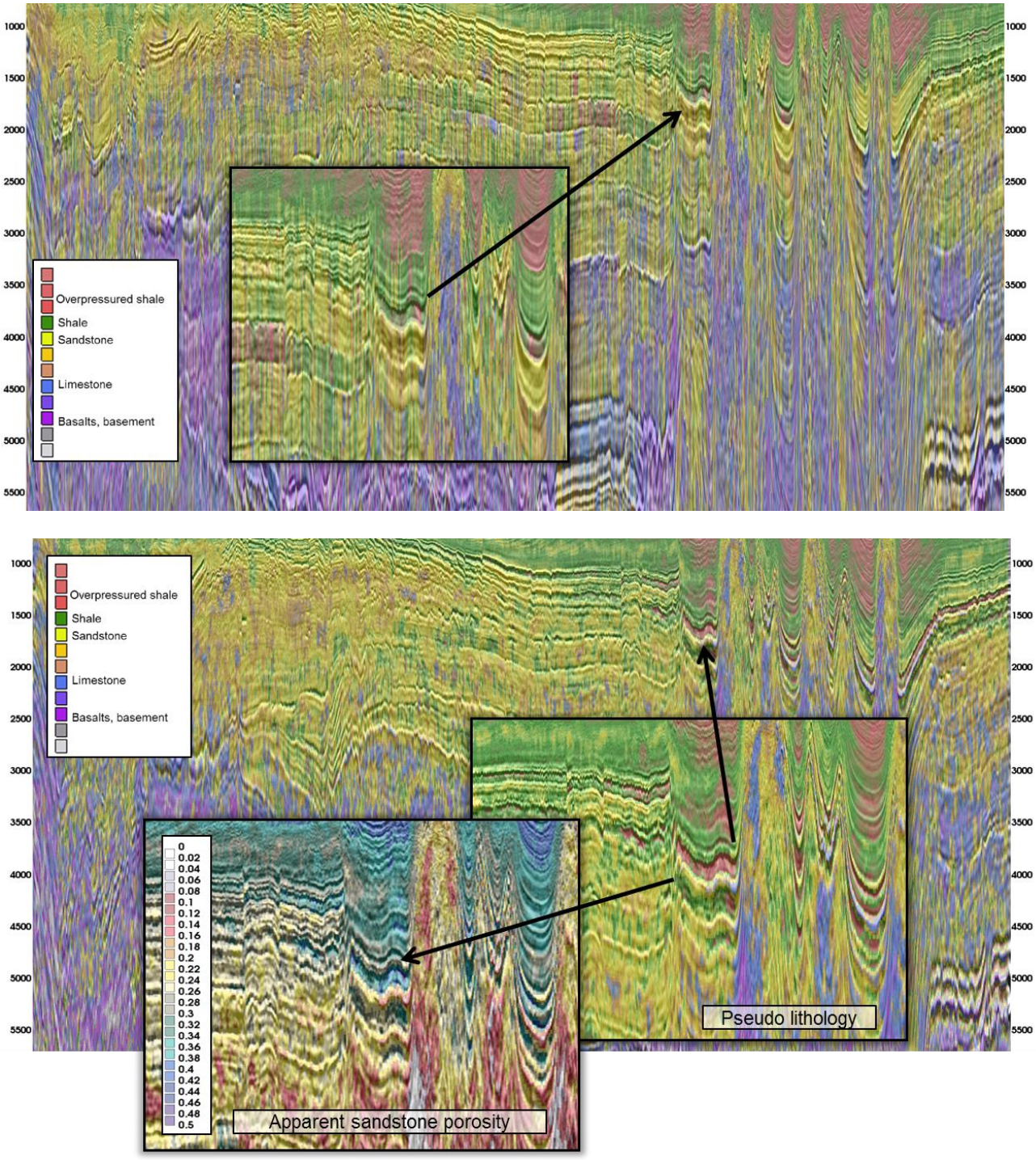


***Figure 1*** *Pseudo Lithology from stacking velocities (top), Pseudo Lithology and apparent sandstone porosity from HighRes velocities (bottom). The HighRes velocities resolve a thin hot shale layer (red), and are less noisy. There are sandstones with reservoir potential below the hot shale, the apparent sandstone porosity indicates porosities between 20% and 25% in these, which is very acceptable for exploration.*

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### References

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