Integrating Well Observations with Seismic Interpretation

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Deep marine sandstones, such as those of the early Tertiary of the Norwegian North Sea, are commonly associated with subtle but detectable areal thickness anomalies. Mapping such departures from background shale thickness is therefore an effective exploration tool. So-called ‘constant shale thickness’ models are often employed, whereby the maximum shale thickness from offset wells is used as a ‘worst-case scenario’, the remaining thickness being assumed to be sand. However, the method is usually an over-simplification, and thickness anomalies may be so subtle that it is difficult to separate them from other, non-sandy variations in thickness. This paper presents an alternative approach which allows shale thickness to be more confidently predicted in areas with some well control. The key innovation is to make more use of the information in the wells, bringing geology into the seismic analysis.

Sand thickness from offset wells is plotted against a series of interval attributes from seismic, such as time difference, time quotient, and maximum amplitude. Data variance is also plotted as a function of offset, to give the degree of uncertainty in the result. Regressions are calculated for the crossplots, with the two or three most reliable correlations being selected. Again, correlation coefficients indicate confidence in the predictions. These relationships may then be used to predict sand thickness based on the relevant seismic attributes, using simple horizon calculations. Relationships between parameters may be linear, polynomial, exponential or logarithmic, and generally yield a range of sand prediction maps while giving insight into uncertainty and risk.