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Seismically constrained lithology modelling

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Quantitative reservoir characterisation often requires that the lithology distribution is described in detail. For example, in carbonates variations in the porosity versus permeability relationships can be associated with different rock fabrics, which can be defined as lithology types. Therefore in order to build models of permeability of the reservoir for flow simulation we must first not only build models of porosity but also associated models of lithology.

There are many techniques to build lithology models. Many of these techniques are based on geostatistics in order to ensure that the models honour the well data and to incorporate the inherent uncertainty in constructing such models. In the absence of tight well control the uncertainty in the lateral distribution of lithology can be very high. In many environments seismic data respond to variations in lithology. Since seismic data sample the subsurface densely, the seismic data can be used to help constrain the distribution of lithology during modelling and thereby reduce uncertainty.

This paper demonstrates through the presentation of a number of examples from the SE Asia region a technique called geostatistical inversion with lithology simulation. In this approach models of lithology are constructed geostatistically in such a way that they explicitly match the seismic data. Models can be constructed with detail beyond the seismic bandwidth. The practical steps in the implementation of the technique are shown along with techniques to analyse the multiple realisations that result from this method.

The examples presented are from both clastic and carbonate environments and show the importance of lithology modelling to quantitative reservoir characterisation.

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