An Integrated Approach to Modeling Reservoir Quality

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ABSTRACT

Understanding the controls on reservoir quality (porosity and permeability) away from well control is critical for determining the economic feasibility for exploration prospects and in reservoir development. Present day reservoir quality is a function of the often complex diagenetic effects of burial history on primary depositional fabric and mineralogy. Successful integration with other subsurface disciplines, such as sedimentology and petroleum systems, is vital in understanding the variability of these key inputs. Over a number of years BP has developed a workflow to integrate subsurface data from a variety of sources, this comprises three main steps; 1, Collection, quality assurance and presentation of data in a relational database, 2, Establishing the geological controls on reservoir quality, 3, Choosing an appropriate model to predict reservoir quality and understand it's subsurface distribution. As part of BP's reservoir quality workflow, we have developed a prediction toolkit to include in-house reservoir quality prediction software. This software uses simple lithological input parameters (e.g., grain size, ductile content, etc.) and effective stress and temperature history to predict porosity and permeability based on calibrated mechanical compaction and quartz cementation algorithms. The software is an effective and pragmatic approach to reservoir quality prediction, and may be used throughout the value chain from access and exploration where well data are limited, through to reservoir development where data are relatively abundant. The original Microsoft Excel based tool has recently been developed as a Petrel plugin, resulting in a simple mapping ability and greater integration with well and seismic data. Here we show examples of the software calibration and an example of a map-based prediction of quartz cementation as an aid in understanding seismic responses.