

Richard Swarbrick PhD

GeoPressure Technology, Ikon Science

### **“Challenge of Pressure Prediction in Deep Exploration Targets”**

**Abstract:**

As drilling moves to deeper targets (as well as deeper water) as the last frontiers of exploration for remaining hydrocarbon reserves, the challenge of pressure prediction becomes more acute. Traditional porosity and/or effective stress-based prediction of pore pressures works well in low-temperature, fine-grained clastics (shales, claystones) but progressively under-estimates pore pressures when chemical compaction and fluid expansion processes generate additional overpressures. Under-estimates of pore pressure lead to drilling surprises and may result in a blow-out. Gas generation (fluid expansion) and a wealth of chemical changes (framework weakening) create overpressures which are not captured ahead of the bit by analysis of seismic data, nor by traditional approaches using offset well data. For example, smectite-illite transformation is one of a number of chemical changes in the Gulf of Mexico which create both overpressure and a new set of rock properties which are independent of effective stress. We now have other rare case studies elsewhere which indicate the typical temperature threshold and the amount of overpressure resulting from such processes, which need to be incorporated into future pressure prediction at depth. Fracture pressure prediction is also challenging, especially as fracture strength varies with pore pressure. New studies of pore pressure-stress coupling ratios will be reviewed which challenge earlier published values.