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## **Developing Pressure Histories Through Basin Modeling**

Development of a pressure history is a key step in pore pressure prediction, of importance both to well design and safety as well as understanding seal integrity, maturation/migration history of petroleum and the impact of changing effective stress on reservoir quality. Basin modeling offers a unique insight into reservoir and non-reservoir pressure history. Principal uncertainties relate to overpressure origin, compaction behavior of mixed lithologies and the permeability evolution of fine-grained sediments. New compaction and poro-perm relationships have been developed and successfully applied to Gulf of Mexico and North Sea case studies. Pressure histories are validated using present-day pressure measurements as well as palaeopressure determinations using fluid inclusions.

The Gulf of Mexico case study was located in a salt-bounded mini-basin in 1000 feet water depth. The dominant lithology is shale mudrock, with intermittent and discontinuous turbiditic sands. 3-D basin modeling reveals early overpressure development due to rapid burial and ineffective dewatering of the mudrocks. Some variability in reservoir pressures results from up-dip connectivity of sand bodies (lateral transfer). Direct measurement of shale porosity (approximately 20%) and permeability (10's nanoDarcy) from core samples corroborates the basin model permeability evolution predictions.

The 2-D North Sea case study addressed issues relating to highly variable clay content in the shale mudrocks, chemical compaction in chalk (a regional pressure barrier) and compartment breach at Jurassic reservoir level due to fault seal failure within the last 2 My. Pressures are validated using petroleum-filled fluid inclusions, applying a novel palaeopressure technique.