Critical Factors for Prospect Evaluation in Salt-Controlled Basins

Kukla, Peter A., and Janos L. Urai, RWTH Aachen University, 52062 Aachen, Germany

The presence of salt has a major control on the tectonic evolution of sedimentary basins, because of the rheological contrast with the surrounding sediments. In addition, evaporites have a strong control on fluid flow in a basin, because of their very low permeabilities and ductility. We illustrate these concepts with case studies from Permian Salt Basins in Europe and Precambrian to Paleozoic Salt Basins from the Middle East.

High quality 3-D seismic data integrated with structural modelling improves the definition of salt structure and associated sediment architecture in salt-controlled sequences. Paleo-cap rocks inside the diapirs point to long phases of dissolution. Salt wedges formed by extrusion and lateral flow of salt glaciers during periods of diapir emergence and reduced sediment accumulation can be accurately modelled. Although salt is widely regarded as a perfect seal, it can become permeable for one- or two-phase fluids under certain conditions of fluid pressure, temperature and deviatoric stress. The fluid pathways can be either along zones of diffuse grain boundary dilatancy, or along open fractures, depending on the fluid overpressure and deviatoric stress. The fluid can form halite veins or networks of brine-filled grain boundaries which conduct fluid from primary inclusions during recrystallization. The main criterion for this to occur is the presence of near-lithostatic fluid pressures, which allow dilatancy and a dramatic increase in permeability. Better understanding of the sedimentary and salt tectonic evolution to improve interpretation, seismic modelling and depth conversion advances the prediction of supra- and sub-salt plays.