Stringers Evolution in Salt Diapirs, Insight from Analogue Models

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Salt diapirs from the middle east or in Southern Permian Basin petroleum province show exotic blocks at outcrop and in salt mines, known as ‘stringers’ in subsurface data, usually composed of anhydrite, dolomite, marls or carbonates. These stringers, which constitute major structures inside the salt diapir, can reach a few km in size and originate from pre-existing brittle rock layers embedded in the salt layer. Stringers of the Ara carbonate within the Precambrian salt in Oman produce oil, but constitute a major exploration risk due to large technical difficulties of structural and seismic imagery, complexity in deciphering their evolution steps, and possible unexpected overpressures. We performed sandbox models imaged with X-ray tomography to study the 4-D structural evolution of such structures. Salt is modelled with Newtonian silicone putty and the internal rock layer by a granular Mohr-Coulomb material, generally coryndon. The growth and geometry of the salt structure is entirely controlled and only driven by the overburden deposition. After a certain amount of ascent, the diapir is killed by the rapid deposition of a thick sand layer on top, and time is given to the floating stringers to fall inside the diapir. The 3-D internal geometry is reconstructed for different steps to show the progressive rise, tearing apart, and fall of the stringers pieces. Complex geometry are observed and compared to natural examples, and the potential of the method for the prediction of geometry, time evolution and pressure distribution will be discussed.