How much salt is there in Ireland's Porcupine Basin?

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The presence or absence of salt in a basin can have dramatic consequences on petroleum systems. In general, evaporites are very good cap rocks and salt constitutes the top seal rock in many oil fields around the world. One type of evaporite, namely halite (sodium chloride / salt), deforms very easily under anisotropic stress-fields with flow-like characteristics. Halite deformation (halokinesis) and the induced deformations of the surrounding sediments provide a wide range of structures for trapping hydrocarbons. Furthermore, halite has a high thermal conductivity, so its presence and relative position (above or below) a potential source rock interval can have a significant effect on the hydrocarbon maturity window. Hence, knowing whether salt is present or absent at depth is an important factor in our understanding of petroleum systems.

In the Porcupine Basin, one well (namely 35/19-1) is known to have encountered salt. It penetrated about 150 m of halite encased in Kimmeridgian-Tithonian claystone. When looking at the seismic section intersecting the well trajectory, it is difficult to conclude if the salt is autochthonous, or, allochthonous. It might have been extruded from deeper and older sedimentary layers (thus interpreted as allochthonous salt) since the well was drilled through a visible fault on the seismic data. However, in favour of the autochthonous salt deposition, paleo-reconstruction of the Porcupine Basin's depositional environment indicates negative annual mean values of precipitation-evaporation rates and very high sea surface salinity during the Tithonian.

Not far north of the Porcupine Basin, well 18/25-1 in the Slyne Basin drilled through over 100 m of lagoonal anhydrite in the Lower Jurassic Hettangian series and about 50 m of halite in the Upper Triassic Rhaetian series. The presence of Rhaetian salt is proven on the conjugate Canadian Atlantic Margin, with the Argo Formation deposited in rift basins on the Scotian Shelf and Grand Banks. In the South Porcupine Basin, new 3D seismic data tentatively show evidence for the presence of salt in the Lower Jurassic–Upper Triassic section in the form of localized diapiric shapes. However, they are difficult to differentiate from structures possibly formed by tectonic inversion, and heavily rotated Jurassic fault blocks detaching on sub-horizontal listric fault planes.

This poster illustrates a number of issues based on the models and observations that we have described above and opens the floor for further studies (such as investigating and modelling seismic velocities) to better understand the distribution and age of salt in the Porcupine Basin.

Atlantic Geology, 2018, Volume 54
Conjugate Margins Conference 2018, August 19-22, 2018
doi: 10.4138/atlgeol.2018.014