Three-phase stability in hydrocarbon vents around the world

Dylan Meyer, The University of Texas at Austin

ABSTRACT

Elevated salinities in hydrocarbon vents around the world result in three-phase stability conditions where water, methane gas, and methane hydrate can co-exist. We examine locations where hydrate is present and use an iterative application of Archie's Law to infer the in situ hydrate saturation and salinity. The conditions required for three-phase stability were determined from equilibrium models. In-situ salinities were found to be equal to or greater than those necessary for three-phase equilibrium at ODP site 1249 between 15 – 50 meters below seafloor (Fig. 2B). Preliminary analysis of other locations suggests that many methane hydrate systems are at three-phase equilibrium.

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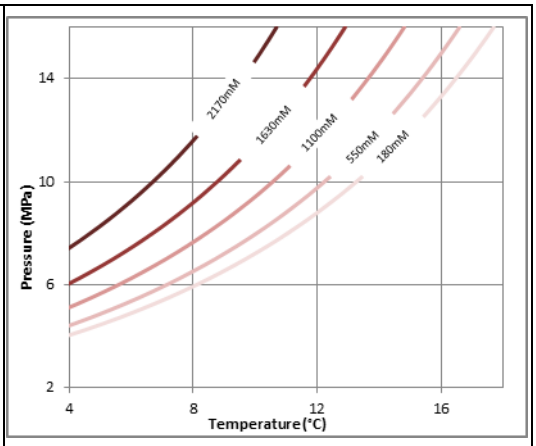


Fig. 1: Pressure and temperature conditions necessary for three-phase equilibrium at particular salinities. As salinity increases, higher pressures and lower temperatures are required for the system to maintain equilibrium.

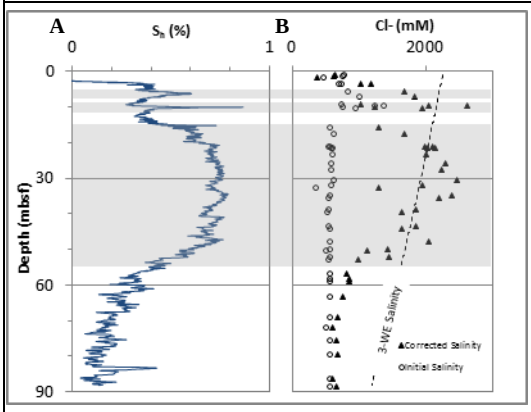
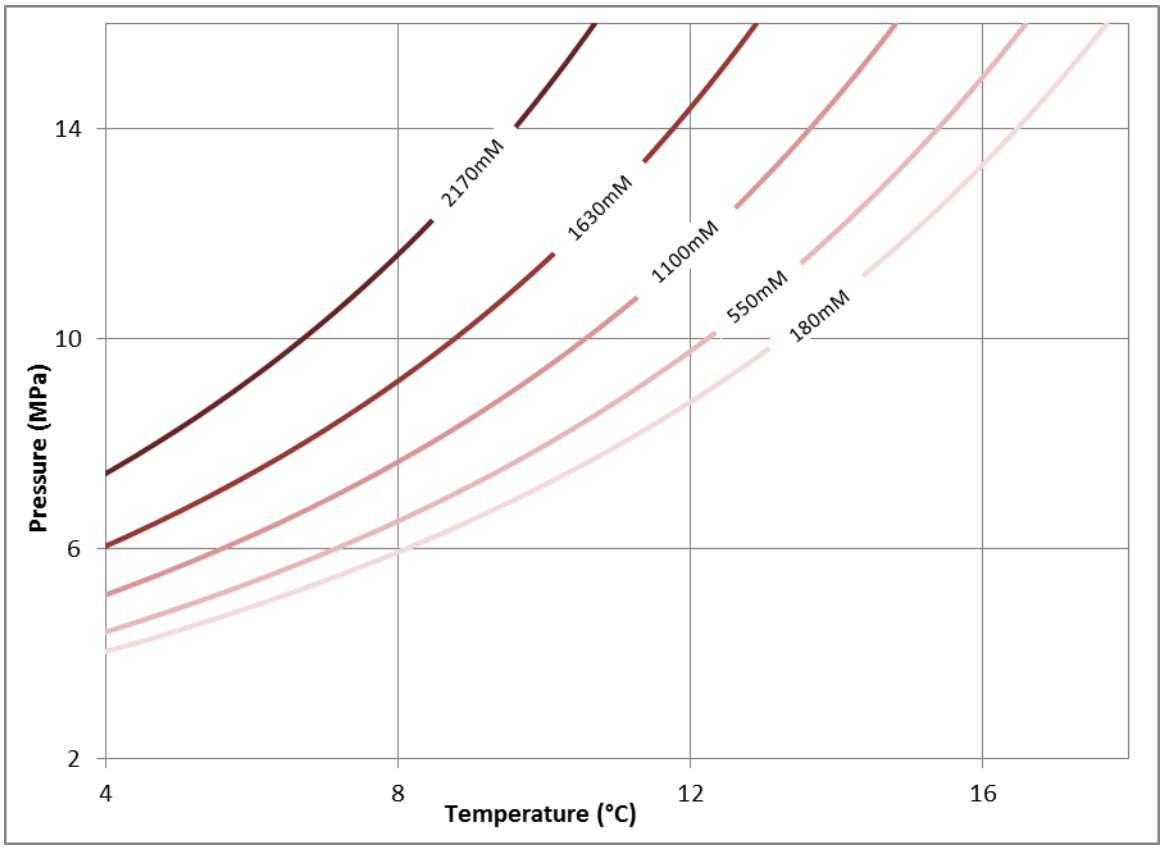


Fig. 2: A) Hydrate saturation with depth at ODP Site 1249. B) Core-derived (circles) and corrected in situ chloride concentration (triangles). Dashed line shows chloride concentration required for three-phase equilibrium at PT conditions for ODP Site 1249.



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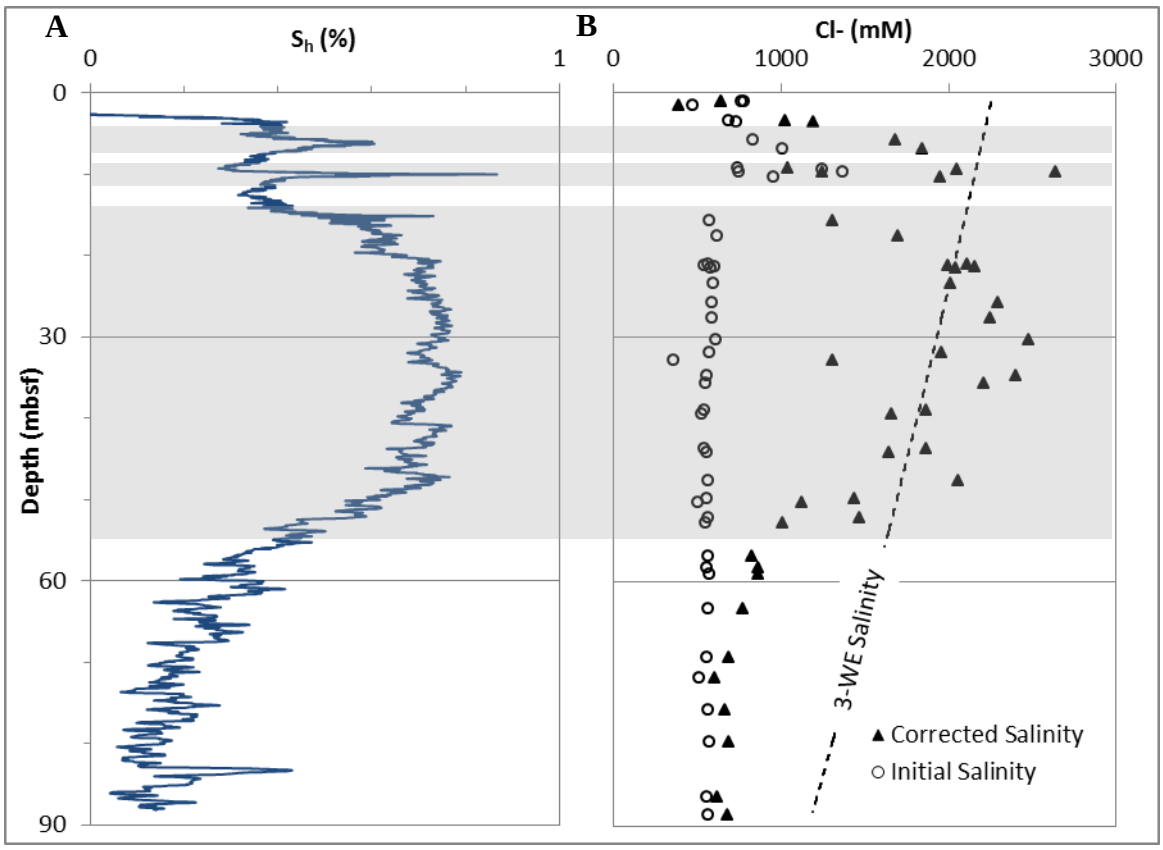

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