

Estimating the gas hydrate recovery prospects in the western Black Sea basin based on the 3D multiphase flow of fluid and gas components within highly permeable paleo-channel-levee systems

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Gas hydrate deposits are abundant in the Black Sea region and confirmed by direct observations as well as geophysical evidence, such as continuous bottom simulating reflectors (BSRs). Although those gas hydrate accumulations have been well-studied for almost two decades, the migration pathways of methane that charge the gas hydrate stability zone (GHSZ) in the region are unknown. The aim of this study is to explore the most probable gas migration scenarios within a three-dimensional finite element grid based on seismic surveys and available basin cross-sections. We have used the commercial software PetroMod(TM) (Schlumberger) to perform a set of sensitivity studies that narrow the gap between the wide range of sediment properties affecting the multi-phase flow in porous media. The high-resolution model domain focuses on the Danube deep-sea fan and associated buried sandy channel-levee systems whereas the total extension of the model domain covers a larger area of the western Black Sea basin. Such a large model domain allows for investigating biogenic as well as thermogenic methane generation and a permeability driven migration of the free phase of methane on a basin scale to confirm the hypothesis of efficient methane migration into the gas hydrate reservoir layers by horizontal flow along the carrier beds.