Basin-scale modelling of gas generation and migration in the Amazon and Nile deep-sea fans: insights into gas hydrate formation

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Résumé

The Amazon and Nile are the world's two largest rivers and supply sediments to deep-sea fans rich in organic matter that host significant gas hydrate provinces. The two fans contain syn-sedimentary fault systems that record gravitational collapse on one or more deep detachments, as well as bottom simulating reflector (BSR) patches and seafloor fluid vents of varying style and distribution. As part of the ANR MEGA project (anr.fr/Project-ANR-22-CE01-0031), we applied numerical modeling to regional cross-sections of the Amazon and Nile deep-sea fans using TemisFlow™, in order to simulate, at basin scale, the generation and migration of both microbial and thermogenic gases into and through the gas hydrate stability zone (GHSZ). Results from the Amazon fan show that thermogenic gas is generated at depth within the fan, both beneath and above the basal shale detachment, but microbial gas dominates at shallower depths and within the GHSZ. The upward migration of microbial gas into the GHSZ and its eventual seepage at the seafloor on the upper slope is controlled by deep-rooted structures (thrust-fold anticlines), rooted on the basal detachment. Upslope of the GHSZ, in the inner extensional zone, gravity-driven extensional faults rooted in the basal detachment, along with permeable lithofacies (sands and carbonates), facilitate the migration and seepage of both thermogenic and microbial gas to seafloor. A similar ongoing study of the Nile fan will allow us to compare these findings with field observations of the gas hydrate systems on both fans.

*Intervenant

Mots-Clés: Deep sea fans, Microbial gas, Bottom Simulating Reflector (BSR), Gas Hydrate Stability Zone (GHSZ), Gas hydrates.