Growth Fault–Gas Hydrate Conveyor Belt

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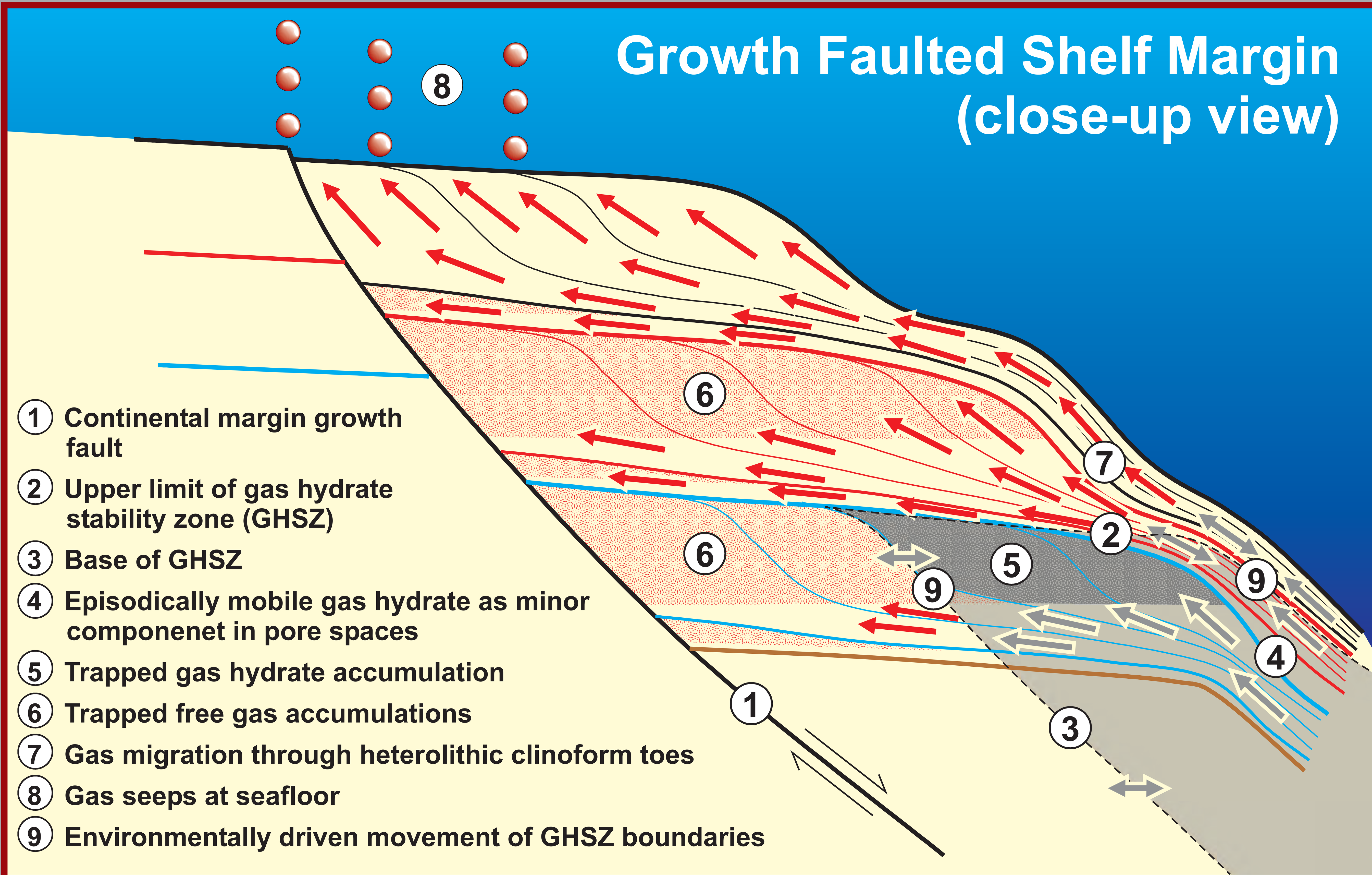

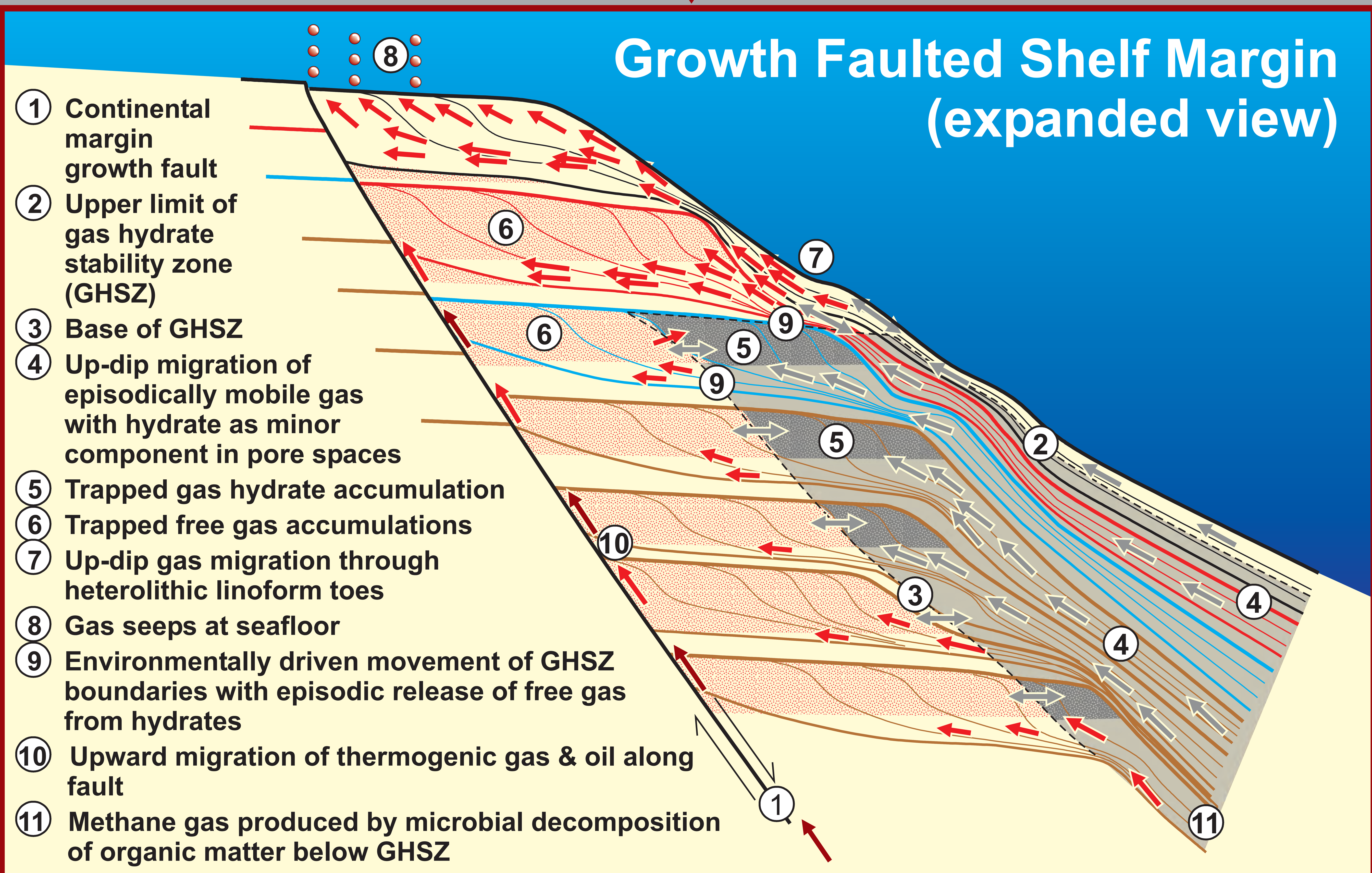

Conclusions

Recent studies of the shelf to slope transition in the northern Gulf of Mexico have demonstrated that the shelf edge is constructed largely of laterally offset and stacked deltas. Where core data are available, these deltas display excellent reservoir quality. Based on current studies, they are considerably more sand-rich than their high-stand counterparts. High-resolution seismic reflection profiles frequently display the high amplitude and blanking effects of gas in the lower portions of associated clinoform sets. Also gas is frequently observed in the water column on seismic and echo sounder records above shelf edge deltas. These sand-rich clinoform packages, frequently down-thrown to active growth faults, were deposited during periods of falling to low sea level.

In a previous study we demonstrated that shallow salt masses may focus the migration of fluids and gasses from the deep subsurface into shallow stratigraphic units including heterolithic turbidites that are connected up-dip to the shelf edge deltas. In this poster we present a more general model involving the formation and decomposition of gas hydrates within deltaic reservoirs, with or without links to deep-seated thermogenic sources. In the general case, shelf edge deltaic depocenters are linked by heterolithic clinoform toes to oxygen deficient continental slope sediments that have the potential to generate methane through microbial decomposition of organic matter. This model defines a shelf edge delta gas hydrate-growth fault "conveyor belt" gas charging system. The cyclic deposition of successive lowstand deltas drives the downward displacement of reservoir quality sand bodies along the fault. In their journey down the growth fault, any given sand body will be first above the gas hydrate stability zone (GHSZ), and subsequently within and below the GHSZ. The shelf edge delta gas hydrate growth fault conveyor belt is capable of collecting large volumes of gas at shallow stratigraphic depths above the hydrate stability zone, fed from linked down dip sources. Movement of the delta down the fault into the GHSZ incrementally sequesters gas in a condensed form within the reservoir sands. The gas is thus stabilized within the reservoir and the porosity and permeability of the reservoir is also stabilized and protected from early diagenesis. Following additional displacement down the fault the reservoir emerges below the base of the GHSZ causing the gas hydrate to dissociate into a readily available source of over pressured gas. Potential migration of this over pressured gas up and down the growth fault may charge both up-thrown and down thrown reservoir strata.

In the Gulf of Mexico it is unlikely that reservoirs would be charged with purely biogenic gas. It is more likely that deep-seated faults and salt bodies provide conduits for thermogenic fluids and gases to enter the shelf edge delta gas hydrate-growth fault conveyor belt system.

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