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Quantitative study of reservoir quality changes due to methane hydrate formation

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Subsurface methane hydrates have long been regarded as a potential energy source to power the future. Significant research efforts have been dedicated towards the exploration of methane hydrate reserves around the world. This study is focused on quantifying the diagenetic changes that occur during and after the formation of methane hydrates in the subsurface. A 2-dimensional geological model representative of the Gulf of Mexico subsurface stratigraphy has been prepared. Numerical simulation has been done using TOUGH+HYDRATE, a code developed at Lawrence Berkeley National Laboratory for modeling of hydrate bearing sediments using Integrated Finite Difference Method. Flow of thermogenic methane gas formed at a high pressure and temperature was simulated through a normal fault with shale and sandstone layers on top of each other. Preliminary results from the model is used as the representative of the hydrate formation phenomenon. Changes in the pressure, temperature, saturation of phases and permeability of the system is mapped in order to characterize the reservoir. As the rock and fluid flow properties are altered, the rate, location and shape and size of the hydrate formation changes. As the hydrates accumulate in the pores of the reservoir, the permeability of the hydrate zone decreases due to the clogging of the pores by solid hydrates. Inclusion of impermeable boundaries also determine the accumulation pattern and size of the hydrate formation.

References

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