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Pore scale modelling of elastic properties of hydrate bearing sediment based on high resolution synchrotron x-ray computed tomography imaging

Wednesday, 2 June 2021 19:50 (15 minutes)

Gas hydrate contains abundant methane and is expected to be a promising energy supply to mitigate the influence of climate change in the future, in addition, it is also relevant to geological hazards. Understanding the effect of fluids-solid-hydrate spatial distribution on elastic properties of hydrate-bearing sediments benefits the interpretation of the Bottom Simulating Reflection and acoustic logging data.

The elastic properties of gas hydrate-bearing have been investigated with various approaches, such as lab-based measurements and analytical models. But these methods fail to capture the influence of detailed pore structure and phase distribution on elastic properties. Alternatively, pore-scale imaging technologies (e.g., Sahoo, et al., 2018), has been used to understand the detailed pore-scale fluids-solid-hydrate distribution on the elastic wave properties. But pore-scale numerical simulation of elastic properties based on high resolution detailed fluids-solid-hydrate images is still rare.

In this work, effective elastic properties of gas hydrate-bearing were simulated by the finite element method based on high-resolution synchrotron x-ray computed tomography imaging. The results show that the dominant hydrate morphology experiences a transition from pore-filling to pore-bridging and to cementation during the hydrate formation process. Remarkably, some hydrate forming in small pores can cement adjacent granules and form local pore-bridging, which increases the rock elastic moduli and sonic wave velocities significantly even when hydrate saturation is low.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

Reference:
Sourav K. Sahoo, B. N. Madhusudhan, Hector Mar´ın-Moreno, Laurence J. North, Sharif Ahmed, Ismael Himar Falcon-Suarez, Tim A. Minshull, and Angus I. Best. Laboratory insights into the effect of sediment-hosted methane hydrate morphology on elastic wave velocity from time-lapse 4-d synchrotron x-ray computed tomography. Geochemistry, Geophysics, Geosystems, 19(11):4502–4521, 2018.

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