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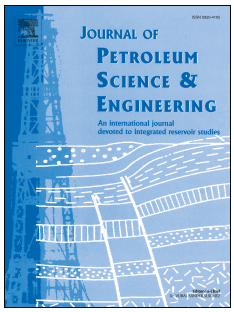

Effect of sediment particle size on the mechanical properties of CH_4 hydrate-bearing sediments

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Abstract:

Previous study proved that the methane hydrate reservoirs in clay permafrost regions have great potential for exploitation. However, the widespread gradation of sediment matrices in hydrate-bearing sediments (HBS) would seriously affect the stability of the hydrate reservoirs, causing uneven distribution of pressure at the wall of the exploitation wellbore, and leading to a severe engineering hazard. Therefore, the effects of the sediment particle size on the mechanical stability of hydrate reservoir need to be investigated before the large-scale commercial production of methane hydrate. In this paper, sediments matrices containing different proportions of clay, silt and sand were prepared and mechanical properties of HBS were investigated and compared with each other. The results show that a bigger proportion of large-particles in the sediment matrix could significantly enhance the failure strength of HBS under different confining pressures, temperatures and strain rates. A better graded size distribution would also boost the failures strength of HBS, it's also found that the failure strength of HBS firstly increases and then declines with the rise of confining pressure, and that material exhibits greater failure strength at lower temperatures and higher strain rates. Finally, an analysis using Mohr-Coulomb strength theory indicates that the internal friction angle plays a dominant role in the failure strength increase of HBS with a greater proportion of large-particles in the sediment matrix.