Predictions of the Dissociation of Hydrate in Sediment Samples with Numerical Heat Transfer Models Based on Fourier's Law

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The rates of dissociation of homogeneous cylindrical hydrate sediment cores has been investigated by radial heat transfer for structure I and structure II hydrates. Heat transfer models based on Fourier's Law with two moving boundaries were developed in cylindrical coordinates. Boundary conditions of constant wall temperature, constant heat flux, and transient exterior temperature were successfully applied to predict the dissociation rate for laboratory scale experiments on pure hydrates and artificially created sediment cores.

The heat transfer models were developed in cylindrical coordinates and were solved numerically using a finite difference grid and the standard explicit scheme. The models were found to replicate well the experimental observations with no fitted parameters, provided that sufficient information is available on the thermophysical properties of the sediment before and after the hydrate has dissociated. The models can be used when planning the recovery of natural sediment cores from the seafloor in order to help devise the optimal recovery conditions to minimize hydrate dissociation.