Validation of hydro-geomechanical properties in high pressure triaxial device for hydrate-bearing core analysis

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Abstract

In the last 20 years, there has been an international effort to develop approaches to experimentally measure the petrophysical and geomechanical properties of hydrate-bearing core samples. The measurements are extremely challenging because sub-sampling, sample preparation, and testing must be conducted at high pressure and low temperature. Despite these challenges, multiple laboratories are now measuring the geotechnical properties of hydrate-bearing sediments. However, there have been relatively few attempts to validate these measurements. We developed experimental protocols to accurately conduct zero-lateral strain tests at effective stresses up to 20 MPa using a pressure core triaxial device. We directly measure displacement during compression through periodic instantaneous undrained loading. To evaluate the accuracy of our measurement system, we conducted a benchmark study to compare properties obtained in our pressure core test chamber against classical geotechnical devices. We prepared a Boston Blue Clay specimen through re-sedimentation. Comprehensive properties databases favor the use of this material for comparison analyses. A compression test to 20 MPa accurately reproduced the compression, lateral stress, and permeability behavior demonstrated in previous testing programs. This experimental procedure provides a convenient framework for future validation studies in a broad range of pressure core laboratory devices.