Geochemistry, Geophysics, Geosystems

Supporting Information for

The impact of grain size on the hydromechanical behavior of mudstones

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Additional Supporting Information (Files uploaded separately)

Caption for Table S1

Introduction

This supporting information provides details for Figure 10 in the main article.

Text S1.

Because I could not easily determine the stress range, over which the compression index (C_c) was calculated in Guo and Underwood (2014) and Kitajima and Saffer (2014), I used their compression data to derive C_c myself along the virgin compression line. Samples that this applies to are marked with an asterisk in Table S1. The stress range is important for the conversion of C_c to the coefficient of volume compressibility (m_v):

$$m_v = \frac{C_c}{(1+e_1)} \frac{\log_{10}\left(\frac{\sigma'_{v,2}}{\sigma'_{v,1}}\right)}{(\sigma'_{v,2}-\sigma'_{v,1})} = \frac{C_c}{(1+e_1)} \frac{\log_{10}(\sigma'_{v,2})-\log_{10}(\sigma'_{v,1})}{(\sigma'_{v,2}-\sigma'_{v,1})}, \quad \text{(Eq. S1)}$$

where $\sigma'_{v,1}$ and $\sigma'_{v,2}$ are the reference vertical effective stresses and e_1 and e_2 are the corresponding void ratios. m_v is needed to determine the coefficient of consolidation (c_v) following the relationship below:

$$c_v = \frac{k_i}{m_v \, \mu_w}, \quad \text{(Eq. S2)}$$

where k_i is the in situ permeability, m_v is the coefficient of volume compressibility, and μ_w is a water viscosity of 0.001002 Pa s for a temperature of 20°C. All values calculated using Equations S1 and S2 and plotted in Figure 10 in the main article are summarized in Table S1.

The c_v values reported here for studies by Hüpers and Kopf (2012), Guo and Underwood (2014), and Kitajima and Saffer (2014) may be slightly different from the reported values in their research articles as they used c_v values determined from the incremental and/or constant rate of strain consolidation tests using the consolidation theory as opposed to the relationship in Eq. S2 used here. However, for consistency, I determined c_v for all samples the same way. Therefore, the relative changes in c_v between all samples are reflected correctly.

Table S1. *Comparison of Hydromechanical Properties of the six Nankai Mudstone – Silt Mixtures with Previously Published Results.*

Note. $\boldsymbol{\sigma'_{v,1}}$ and $\boldsymbol{\sigma'_{v,2}}$ = reference vertical effective stresses. e_1 and e_2 = void ratios at reference vertical effective stresses. C_c = compression index. m_v = coefficient of volume compressibility. k_i = in situ permeability. c_v = coefficient of consolidation calculated as following. * = calculated in this study based on the author's data.