Temperature effects on stiffness and strength of high porosity chalk
is it significant?

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Temperature effects on stiffness and strength of high porosity chalk – is it significant?

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The answer is "No or only to minor degree". Successful depletion and management of petroleum and geothermal reservoirs depend on reliable mechanical rock failure/pore collapse estimates and the effective stress field, where the rock frame stiffness controls the latter. Thus, we need quantification and understanding of temperature-induced mechanisms to avoid introducing erroneous estimates of rock frame stiffness and mechanical failure properties. Accordingly, we experimentally assessed temperature-induced changes in stiffness and compaction properties of dry, oil, and tap-water saturated high porosity (≈ 44%) Lower Cretaceous chalk from the Danish North Sea. The intention was to minimize geochemical fluid effects and to test only at ambient and in situ temperatures. The results show minor to no effect of testing temperature on static and dynamic frame stiffness as well as on the stress level leading to pore collapse (Figure 1). We propose that the ratio of thermal expansion coefficient to temperature-induced decrease in mineral stiffness is the governing factor behind the experimental observations.

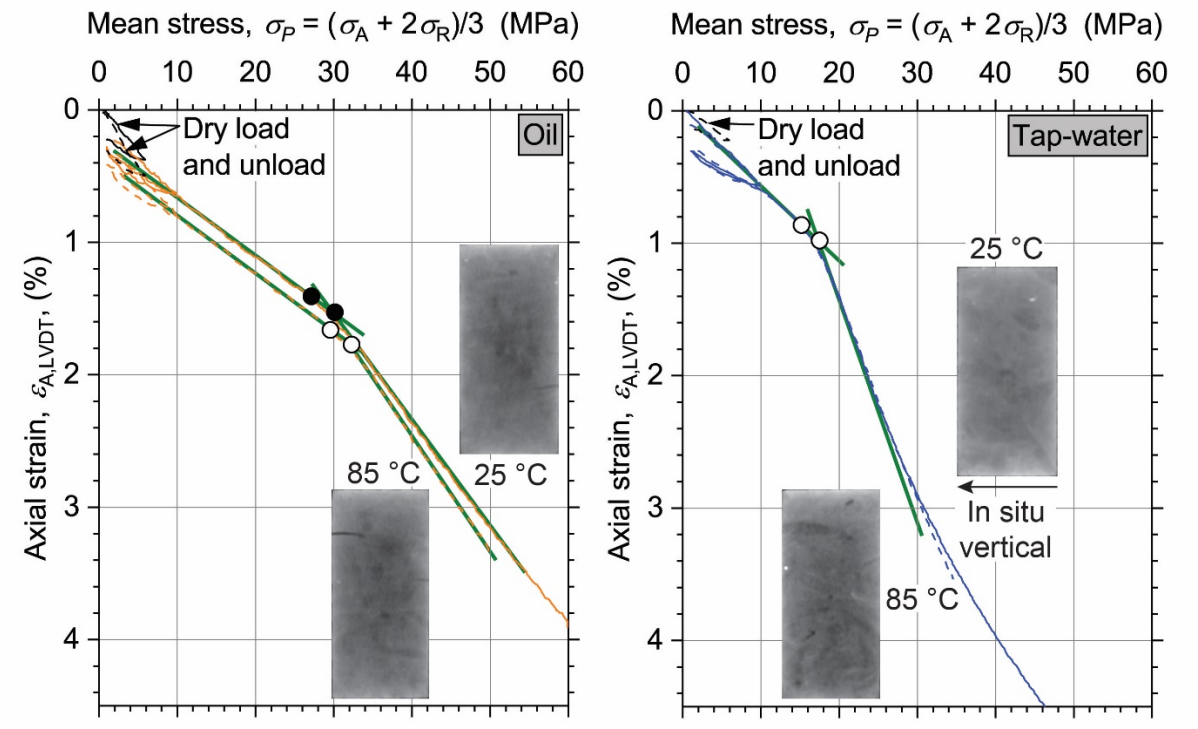

Figure 1. Mean stress vs. axial strain during hydrostatic compaction of high porosity chalk Left: Oil saturated. Rigth: tap-water saturated. Images show medical CT-scan taken before testing. Dashed and solid lines represent testing at ambient and in situ (85 ˚C) temperatures, respectively. Black and white markers show onset and pragmatic pore collapse for ambient and in situ (85 ˚C) temperature, respectively.