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Organisations

Assistant Professor, Department of Civil Engineering
04/07/2003 → present
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VIP

Section for Geotechnics and Geology
08/03/2012 → present
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Center for Energy Resources Engineering
22/01/2013 → present
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Publications:

Strength and Biot's coefficient for high-porosity oil- or water-saturated chalk

In the petroleum industry it is relevant to know the Biot coefficient for establishing the effective stresses present in both the overburden and for the reservoir interval. When depleting a reservoir it is important to estimate the settlement through the strain imposed by the effective stress. Also considerations for the size of the drilling window and the magnitude of the lateral stress involve the Biot coefficient. Additionally, the fluid effect of oil-saturated chalk behaving much stronger than water-saturated chalk affects geomechanical considerations related to e.g. water injection into a reservoir.
The Biot coefficient states the degree of cementation or how the pore pressure contributes to the strain resulting from an external load for a porous material. It is here calculated from dynamic measurements and correlated with the strength of outcrop chalk characterized by the onset of pore collapse during hydrostatic loading. The hypothesis is that the Biot coefficient and the theory of poroelasticity may cover the fluid effect by including the increased fluid bulk modulus from oil to water. A high number of test results for both oil- and water-saturated high-porosity outcrop chalk show correlation between the Biot coefficient and the strength.

General information

State: Published
Organisations: Department of Civil Engineering, Section for Geotechnics and Geology, Center for Energy Resources Engineering
Authors: Andreassen, K. A. (Intern)
Number of pages: 5
Publication date: 2014
Event: Paper presented at 48th US Rock Mechanics / Geomechanics Symposium, Minneapolis, United States.
Main Research Area: Technical/natural sciences
Electronic versions:

author_6937_v4_1.pdf
Source: PublicationPreSubmission
Source-ID: 118925129
Publication: Research - peer-review › Paper – Annual report year: 2015

Poroelasticity of high porosity chalk under depletion

The theory of poroelasticity for the elastic region below pore collapse by means of three different loading paths gives the possibility to compare the static and dynami-cally determined Biot coefficient for a set of experimental data with uniaxial loading on outcrop chalk performed with different levels of pore pressure. The chalk is oil-saturated Lixhe chalk from a quarry near Liège, Belgium, with a general porosity of 45%. Additionally, we compare the theoretical lateral stress to the experimentally determined lateral stress at the onset of pore collapse.
The static Biot coefficient based on mechanical test results is found to be low-er than the pretest dynamic Biot coefficient determined from elastic wave propagation for the loading path and with less deviation under depletion. The calculated lateral stress is lower than the experimentally measured lateral stress depending on loading path. An explanation to this behaviour is pore pressure build up.

General information

State: Published
Organisations: Department of Civil Engineering, Section for Geotechnics and Geology, Center for Energy Resources Engineering

Authors: Andreassen, K. A. (Intern), Fabricius, I. L. (Intern)
Pages: 2423-2430
Publication date: 2013

Host publication information
Title of host publication: Poromechanics V : Proceedings of the Fifth Biot Conference on Poromechanics
Publisher: American Society of Civil Engineers
ISBN (Print): 978-0-7844-1299-2
Main Research Area: Technical/natural sciences
Conference: Fifth Biot Conference on Poromechanics, Vienna, Austria, 10/07/2013 - 10/07/2013
DOIs:
10.1061/9780784412992.283
Source: dtu
Source-ID: u::8338
Publication: Research - peer-review › Book chapter – Annual report year: 2013

Cretaceous Chalk at the Fehmarnbelt Fixed Link Site

General information
State: Published
Organisations: Department of Civil Engineering, Section for Geotechnics and Geology
Authors: Andreassen, K. A. (Intern), Foged, N. N. (Intern)
Pages: 311-316
Publication date: 2012

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Title of host publication: Proceedings of the 16th Nordic Geotechnical Meeting
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Main Research Area: Technical/natural sciences
Conference: Nordic Geotechnical Meeting , Copenhagen, Denmark, 09/05/2012 - 09/05/2012
Source: dtu
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Publication: Research - peer-review › Article in proceedings – Annual report year: 2012

Temperature Influence on Rock Mechanical Properties: High-Porosity, Low-Cemented Chalk

General information
State: Published
Organisations: Department of Civil Engineering, Section for Geotechnics and Geology
Authors: Andreassen, K. A. (Intern), Foged, N. N. (Intern), Hededal, O. (Intern), Krogsbøll, A. (Intern)
Publication date: Jun 2011

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Electronic versions:
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Publication: Research › Ph.D. thesis – Annual report year: 2011

Biot critical frequency applied as common friction factor for pore collapse and failure of chalk with different pore fluids and temperatures

A fluid effect toward higher strengths for oil-saturated chalk compared with water-saturated chalk has previously been identified and labeled the "water-weakening phenomenon," but has not been further characterized physically. The hypothesis of this paper is that the Biot critical frequency with a strain or stress-rate dependence can be used to explain this behavior on the pore scale and can be extrapolated to the macroscale failure and pore-collapse properties. A large set of previously published laboratory test results on chalk with different pore fluids was collected, and as a supplement we present a new test series on Stevns chalk with unconfined compression and Brazilian strength results. Copyright © 2011 Society of Petroleum Engineers.

General information

State: Published
Organisations: Department of Civil Engineering, Section for Geotechnics and Geology, Center for Energy Resources Engineering
Authors: Andreassen, K. A. (Intern), Fabricius, I. L. (Intern), Foged, N. N. (Intern)
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Pages: 1002-1009
Publication date: 2011
Main Research Area: Technical/natural sciences

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Scopus rating (2015): 1.0 1.317
BFI (2014): BFI-level 1
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BFI (2013): BFI-level 1
Scopus rating (2013): 1.596 2.072
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): 1.637 1.863
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): 2.279 2.06
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): 1.822 2.534
BFI (2009): BFI-level 1
Scopus rating (2009): 1.687 2.133
BFI (2008): BFI-level 1
Scopus rating (2008): 0.667 1.824
Scopus rating (2007): 0.835 0.779
Scopus rating (2006): 1.062 2.877
Scopus rating (2005): 2.392 2.624
Scopus rating (2004): 2.193 2.339
Scopus rating (2003): 1.086 0.911
Scopus rating (2002): 1.917 1.332
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Biot Critical Frequency Applied as Common Friction Factor for Chalk with Different Pore Fluids and Temperatures

Injection of water into chalk hydrocarbon reservoirs has lead to mechanical yield and failure. Laboratory experiments on chalk samples correspondingly show that the mechanical properties of porous chalk depend on pore fluid and temperature. Water has a significant softening effect on elastic properties of chalk as calculated from wave data, and the softening increases with increasing critical frequency as defined by Biot. The critical frequency is the highest frequency where wave propagation is controlled by solid-fluid friction. The Biot critical frequency is thus a measure of this friction and we propose that the fluid effect on mechanical properties of highly porous chalk may be the result of liquid-solid friction. Applying a different strain or stress rate is influencing the rock strength and needs to be included. The resulting function is shown to relate to the material dependent and rate independent b-factor used when describing the time dependent

mechanical properties of soft rock or soils. As a consequence it is then possible to further characterize the material constant from the porosity and permeability of the rock as well as from pore fluid density and viscosity which is highly influenced by temperature.

General information
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Organisations: Section for Geotechnics and Geology, Department of Civil Engineering, Department of Environmental Engineering, Center for Energy Resources Engineering
Authors: Andreassen, K. A. (Intern), Fabricius, I. L. (Intern)
Pages: 1-10
Publication date: 2010

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Title of host publication: 44th US Rock Mechanics Symposium : 5th U.S. -Canada Rock Mechanics Symposium
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Main Research Area: Technical/natural sciences
Conference: 44th US Rock Mechanics Symposium and 5th U.S. -Canada Rock Mechanics Symposium, Salt Lake City, USA, 01/01/2010
Source: orbit
Source-ID: 270967
Publication: Research - peer-review › Article in proceedings – Annual report year: 2010

Biot Critical Frequency Applied as Common Friction Factor for Pore Collapse and Failure of Chalk with Different Pore Fluids and Temperatures (SPE - 130447)

General information
State: Published
Organisations: Center for Energy Resources Engineering, Department of Civil Engineering, Department of Environmental Engineering, Section for Geotechnics and Geology
Authors: Andreassen, K. A. (Intern), Fabricius, I. L. (Intern), Foged, N. N. (Intern)
Pages: EU04
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Volume: Conference proceedings & exhibitors' catalogue. CD-ROM
Place of publication: DB Houten, NL
Publisher: European Association of Geoscientists & Engineers Publications B.V. (EAGE)
Main Research Area: Technical/natural sciences
Conference: 72nd EAGE Conference & Exhibition incorporating SPE EUROPEC 2010, Barcelona, Spain, 14/06/2010 - 14/06/2010
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Source-ID: 264899
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2010

Biot Critical Frequency Applied to Description of Failure and Yield of Highly Porous Chalk with Different Pore Fluids
Injection of water into chalk hydrocarbon reservoirs has led to mechanical yield and failure. Laboratory experiments on chalk samples correspondingly show that the mechanical properties of porous chalk depend on pore fluid and temperature. In case of water-saturated samples, the concentration and nature of dissolved salts have an effect.Water has a significant softening effect on elastic properties of chalk as calculated from wave data, and the softening increases with increasing critical frequency as defined by Biot. The critical frequency is the highest frequency where elastic wave propagation is controlled by solid-fluid friction. The reference frequency is thus a measure of this friction, and we propose that the fluid effect on mechanical properties of chalk may be the result of liquid-solid friction. We reviewed 622 published experiments on mechanical properties of porous chalk. The data include chalk samples that were tested at temperatures from 20 °C to 130 °C with the following pore fluids: fresh water, synthetic seawater, glycol, and oil of varying viscosity. The critical frequency is calculated for each experiment. For each specimen, we calculate the thickness to the slipping plane outside the Stern layer on the pore surface. For electrolytes, the thickness of this layer is calculated based on Debye-Hückel theory. The layer reduces the porosity available for fluid flow.We find that the Biot critical frequency based on pore scale data can be used to explain effects on the macro scale.We find that the effective yield stress and also the effective stress of failure in tension as well as in compression are log-linearly related to log reference frequency. This opens the possibility to predict yield and failure under reservoir conditions from mechanical tests made under laboratory conditions. It also opens the possibility of predicting the effects of water flooding on chalk stability.

General information
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Organisations: Department of Civil Engineering, Department of Environmental Engineering, Center for Energy Resources Engineering
Authors: Andreassen, K. A. (Intern), Fabricius, I. L. (Intern)
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Main Research Area: Technical/natural sciences

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BFI (2015): BFI-level 1
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Scopus rating (2014): 1.598 1.398
BFI (2013): BFI-level 1
Scopus rating (2013): 1.628 2.143
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): 1.667 1.844
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): 2.643 1.714
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): 1.416 1.716
BFI (2009): BFI-level 1
Scopus rating (2009): 2.382 3.215
BFI (2008): BFI-level 1
Scopus rating (2008): 1.248 1.276
Scopus rating (2007): 1.197 1.535
Scopus rating (2006): 1.247 2.082
Scopus rating (2005): 0.805 1.38
Scopus rating (2004): 1.395 2.061
Scopus rating (2003): 1.47 2.895
Scopus rating (2002): 1.42 1.637
Scopus rating (2001): 0.858 1.454
Scopus rating (2000): 0.762 1.397
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Original language: English
DOIs:
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Creep of Highly Porous Chalk and Biot Critical Frequency

General information
State: Published
Organisations: Section for Geotechnics and Geology, Department of Civil Engineering, Department of Environmental Engineering, Center for Energy Resources Engineering
Authors: Andreassen, K. A. (Intern), Fabricius, I. L. (Intern), Foged, N. N. (Intern)
Pages: 1-2
Publication date: 2010

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ISBN (Print): 978-90-73781-86-3
Main Research Area: Technical/natural sciences
Conference: 72nd EAGE Conference & Exhibition incorporating SPE EUROPEC 2010, Barcelona, Spain, 14/06/2010 - 14/06/2010

Bibliographical note

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Source: orbit
Source-ID: 270972
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2010

Water weakening of chalk explaied from a fluid-solid friction factor

The hypothesis behind this paper proposal is that the Biot critical frequency can be used to characterize the water weakening phenomenon physically. The Biot critical frequency determines the transition from where an applied sound velocity on a saturated porous chalk is dominated by viscous forces to where it is dominated by inertial forces, i.e. when the pore fluid motion lags behind the applied frequency. It is therefore a measure of the internal surface friction between solid and fluid which can be interpreted as a friction factor on the pore scale and we propose it can be extrapolated to the macroscale failure and pore collapse properties. The Biot critical frequency incorporates the porosity, permeability, fluid density and fluid viscosity, where the latter is highly temperature dependent – it does not include the applied sound velocity frequency. The listed parameters are usually determined during laboratory tests and the fluid viscosity and density may be found in tabulated references. There exist a number of previously published laboratory test results on chalk which was collected from Brazilian, unconfined compression and triaxial tests. The data spans four different chalk types which were tested at temperatures from 20°C to 130°C with the following pore fluids: fresh water, synthetic seawater of different chemical compositions, methanol, glycol, and oil of varying viscosity. The data was evaluated according to failure lines and yield envelopes for all fluids and temperatures while using the Biot critical frequency as a single reference. Other viscoplastic parameters were investigated in the same manner to verify the range of the functioning of the friction factor. The findings show that the Biot critical frequency can be used as a common friction factor and is useful in combining laboratory results. It is also inferred that the observed water weakening phenomenon may be attributed to the friction between solid and fluid.

General information

State: Published
Organisations: Section for Geotechnics and Geology, Department of Civil Engineering, Department of Environmental Engineering, Center for Energy Resources Engineering
Authors: Andreassen, K. A. (Intern), Fabricius, I. L. (Intern)
Pages: 26-35
Publication date: 2010

Host publication information

Title of host publication: Rock Mechanics in the Nordic Countries 2010
Volume: Proceedings-DVD
Main Research Area: Technical/natural sciences
Conference: Rock Mechanics in the Nordic Countries : 9.-12. June 2010, Kongsberg, Norway, 01/01/2010
Source: orbit
Source-ID: 270970
Publication: Research - peer-review › Article in proceedings – Annual report year: 2010

Boreability and Bit Wear in Siliceous Limestone and Flint in Malmö

General information

State: Published
Organisations: Section for Building Materials and Geotechnics, Department of Civil Engineering
Authors: Andreasen, K. A. (Intern), Foged, N. N. (Intern)
Publication date: 2004

Publication information

Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 155836
Publication: Research - peer-review › Report – Annual report year: 2004

Projects:

Temperature and poroelasticity of sedimentary rocks

Department of Civil Engineering
Period: 01/09/2014 → 31/08/2017
Number of participants: 3
Phd Student:

Orlander, Tobias (Intern)
Supervisor:

Andreassen, Katrine Alling (Intern)
Main Supervisor:

Fabricius, Ida Lykke (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Citytunneln : Borability and bit wear in Siliceous limestone and flint in Malmö
Expert evaluation of Boreability and bit wear for tunneling in Siliceous limestone and flint at Malmö Citytunnel

Section for Building Materials and Geotechnics

Department of Civil Engineering

Citytunneln
Period: 15/11/2003 → 29/04/2004
Number of participants: 3
Project ID: 25541
Project participant:

Andreassen, Katrine Alling (Intern)

Hartlén, Jan (Ekstern)
Project Manager, organisational:

Foged, Niels Nielsen (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
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