THREE-DIMENSIONAL GEOMECHANICAL MODELING OF FAULT AND FRACTURE STABILITY ANALYSIS IN NATURALLY FRACTURED CARBONATE RESERVOIR

MEHDI TADAYONI

UNIVERSITI TEKNOLOGI MALAYSIA

THREE-DIMENSIONAL GEOMECHANICAL MODELING OF FAULT AND FRACTURE STABILITY ANALYSIS IN NATURALLY FRACTURED CARBONATE RESERVOIR

MEHDI TADAYONI

A thesis submitted in fulfilment of the
requirements for the award of the degree of
Doctor of Philosophy

School of Chemical and Energy Engineering
Faculty of Engineering
Universiti Teknologi Malaysia

APRIL 2021

ACKNOWLEDGEMENT

In first and foremost, I wish to express my most sincere appreciation to my supervisor, PROF. DR. RADZUAN BIN JUNIN, for the opportunity of being part of his research laboratory member and also for the guidance, challenges, and support that he provided during my research which allowed me to further my knowledge, experience, and career. I was taught to carry out the research in a scientifically logical way and be enthusiastic and optimistic in the face of any challenges. I truly appreciate my best friend DR AMIRREZA NADERIPOUR for advice, help, and assessment of my research during my whole Ph.D. study.

I would also like to thank the Universiti Teknologi Malaysia (UTM) for its favourable academic atmosphere which makes me enjoy my research.

Last but not least, my deepest gratitude is reserved for my dearest family. This journey would not have been possible without the support of my beloved wife. I think they would be delighted to see the completion of this thesis. To them, my appreciation never ends.

ABSTRACT

Fault and fracture stability/reactivation, reservoir compaction, and associated surface subsidence are observed in many oil and gas fields worldwide. A better understanding of the geomechanical parameters of reservoir formation and neighbouring lithology is therefore becoming highly important within the oil carbonate field development. Pore pressure, effective stresses, and geological structures as well as their evolution during an oil field life have a considerable impact on wellbore instability and fault and fracture behaviour. The main aim of this study is to determine the causes of faults and fractures instability in a natural fracture reservoir by using integrated wellbore stability (1D) analysis to 3D geomechanical study. In this research, different approaches were used to perform the 3D geomechanical model through integrated analysis of the drilling events, log and rock mechanics data. By 3D finite element, the principal stresses were calculated in two steps. Firstly, the gravity (overburden and underburden) and pore pressure were applied; the second step was involving the sideburden. This study indicates a 3D geomechanical modelling of the oil field as a gentle anticline in the Middle East area. Wellbore stability model (or 1D Geomechanical modelling) contains various stresses, pore pressure, and rock mechanics properties for offset wells were simulated by integrating a wide variety of good data from the field. These calibrated 1D geomechanical outputs were applied to model 3D geomechanical models and were further utilized for fracture and fault reactivation modelling. A 3D reservoir geomechanical modelling (or couple geomechanical modelling) was improved to utilize the geological static and reservoir dynamic models to estimate the changes in reservoir pore pressure and principle stresses in magnitude and orientation. Based on 3D geomechanical modelling, vertical and horizontal stresses have been evaluated for all faults and fractures. The tendency of the fault and fracture reactivation was determined in terms of minimum and maximum horizontal stresses. The simulation result indicated that the change of reservoir pressure during the initial phase of production since 1992 to 2054 has a significant impact on principal stresses in the field. On the other hand, the 3D map of minimum and maximum horizontal stresses on both sides of the main faults explain that faults are most stable compared to fractures in cap rock and reservoir sections. While high porous and permeable reservoir formation and impermeable cap rock (the combination of anhydrite, salt and shale) are experiencing normal to strike-slip stress fault regime, the strain and stress fluctuation due to oil production in more than 60 years' simulation does not have a destructive impact (or activation) on different faults. But fracture behaviour changes from 2017 to 2054 due to pore pressure changes, the fracture instability in different directions was considerable and it must be considered in production optimization.

ABSTRAK

Kestabilan/ pengaktifan semua sesar dan retakan, pemadatan reservoir dan embalesan permukaan berkaitan diteliti berlaku di kebanyakan medan minyak dan gas di serata dunia. Pemahaman yang baik teutang parameter- parameter geomekanik formasi reservoir dan litologi berhampiran menjadi sangat penting bagi pembangunan medan minyak karbonat. Tekanan liang, tegasan berkesan, dan struktur geologi disamping evolusinya ketika hayat medan minyak mempunyai kesan yang agak besar terhadap ketidakstabilan lubang telaga dan tingkah laku sesar dan retakan. Matlamat utama kajian ini adalah untuk menentukan penyebab-penyebab ketidakstabilan sesar dan retakan di dalam sebuah reservoir berretakan semulajadi dengan meggunakan analisis bersepadu kestabilan lubang telaga secara satu dimensi (1D) hingga ke kajian geomekanik tiga dimensi 3D. Dalam kajan ini, pendekatan yang berbeza telah digunakan untuk melakukan pemodelan geomekanik 3D menerusi analisis bersepadu terhadap maklumat penggerudian, data log dan data mekanik batuan. Dengan menggunakan unsur terhingga 3D, tegasan utama dihitung menerusi dua langkah. Pertama, graviti (beban atas dan beban bawah) dan tekanan liang yang dikenakan; langkah kedua melibatkan beban sisi. Kajian ini menunjukkan pemodelan geomekanik 3D bagi medan minyak sebagai antiklin landai di kawasan Timur Tengah. Model kestabilan lubang telaga (atau pemodelan geomekanik 1D) yang mengandungi pelbagai tegasan, tekanan liang dan sifat mekanik batuan daripada telaga ofset telah diselaku menenasi penyepaduan pelbagai jenis data telaga dari medan. Output geomekanik 1D tertentukur telah diaplikasikan terhadap model geomekanik 3D dan kemudiannya digunakan untuk pemodelan pengaktifan semula sesar dan retakan. Pemodelan geomekanik reservoir 3D (atau pemodelan gandingan geomekanik) ditambah baik menggunakan model statik geologi dan model dinamik reservoir untuk menganggar perubahan tekanan liang reservoir dan perubahan tegasan utamanya dalam bentuk magnitud dan halaan. Berdasarkan kepada pemodelan geomekanik 3D, tegasan tegak dan tegasan mendatar telah dinilai untuk kesemua sesar dan retakan. Kecenderungan untuk pengaktifan semula sesar dan retakan telah ditentukan berdasar kepada tegasan mendatar minimum dan juga maksimum. Keputusan penyelakuan menunjukkan bahawa perubahan tekanan reservoir ketika fasa awal pengeluaran sejak tahun 1992 hingga ke 2054 memberikan kesan yang ketara terhadap tegasan-tegasan utama medan. Sebaliknya, peta 3D bagi tegasan mendatar minimum dan tegasan mendatar maksimum retakan pada kedua-dua sisi sesar utama menunjukkan bahawa sesar adalah paling stabil berbanding retakan pada bahagian batuan tukup dan reservoir. Sementara itu, reservoir berliang dan boleh telap dan batuan tukup tak boleh telap (gabungan anhidrit, garam, dan syal) mengalami regim bertegasan normal hingga ke bertegasan jurus gelineir. Berdasarkan turun naiknya terikan dan tegasan berikutan pengeluaran minyak melebihi 60 tahun, hasil penyelakuan menunjukkan bahawa tiada kesan pemusnah (atau pengakifan) terhadap sesar yang berbeza. Walaubagaimanapun, perubahan tingkahlaku retakan dari 2017 hingga ke 2054 disebabkan perubahan tekanan liang, ketidakstabilan retakan pada arah berbeza didapati ketara, dengan kesan itu mesti diambil kira dalam pengoptimumkan pengeluaran.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

API	-	American Petroleum Institute
BBL	-	Barrel
BEM	-	Boundary Element Method
BOE	-	Barrel Oil Equivalent
BIL	-	Borehole Image Log
Cali	-	Caliper
CCF	-	Continuous Conductive Fractures
CCS	-	Confined Compressive Strength
CGR	-	Compensated Gamma Ray
Co	-	Cohesion Factor
CSM	-	Colorado School of Mines
DA	-	Alpha Oil Field
Dc	-	Dc-exponent
DDR	-	Directional Drilling Rate
DEM	-	Distinct Element Method
DSI	-	Dipole Shear Sonic
DT	-	Compressional
1D	-	One Dimensional
3D	-	Three Dimensional
3D	-	Four-Dimensional
EIA	-	Energy Information Agency
EOR	-	Enhanced Oil Recovery
FEM	-	Finite Element Math
FIT	-	Formation Integrity Tests
FMI	-	Full bore Formation Micro imager
G&G	-	Geology & Geophysics
GR	-	Gamma Ray
GWL	-	Graphic Well Log
ISIP	-	Instantaneous Shut In Pressure
LOT	-	Leak of Test

MD	-	Measure Depth
MEM	-	Mechanical Earth Model
NPHI	-	Neutron Porosity
NW-SE	-	North West-South East
OIIP	-	Oil Initially-in-place
OWC	-	Oil Water Contact
Pp	-	Pore Pressure
PRV	-	Produced Reservoir Volume
RCP	-	Reservoir Characterization Project
RHOB	-	Bulk Density
ROP	-	Rate of Penetration
RPM	-	Rotary Per Minutes
RQI	-	Rock Quality Index
QRA	-	Quantitative Risk Analysis
SG	-	Specific Gravity
Sh	-	Minimum Horizontal Stress
SH	-	Maximum Horizontal Stress
SRV	-	Stimulated Reservoir Volume
STC	-	Slowness-Time Coherence
Sv	-	Vertical Stress
TVD	-	True Vertical Depth
TL	-	Time-Lapse
TVD	-	True Vertical Depth
UCS	-	Unconfined Compressive Strength
WOB	-	Weight On Bit
WBS	-	Wellbore Stability Analysis
XLOT	-	Extended Leak Off Test

LIST OF SYMBOLS

σ	-	Stress
σ_V	-	Maximum Principal Stress
σ_H	-	Maximum Horizontal Stress
σ_h	-	Minimum Horizontal Stress
E	-	Young's Modulus
v	-	Grid Voltage
ρ	-	Bulk Density
V	-	Compressional Velocity
Vs	-	Shear Velocity
Zp	-	Compressional Impedance
Zs	-	Shear Impedance
σ_T	-	Tensile Strength
σ'	-	Hoop Stress
Pp	-	Pore Pressure
Pw	-	Wellbore Pressure
g	-	Gravitational Constant
Φ_b	-	Breakout Width, Degree

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Problem Background

Due to the field 3D geomechanical analysis serves as a complexity for declining budget and increasing efficiency over the life of a field, the information contained in a geomechanical model makes it possible to assess exploration risk associated with fault-seal breach caused by fault slip. Also, natural fault/fractures have a dramatic impact on carbonate reservoirs in terms of oil recovery. A 3D geomechanical model also makes it possible to design completions to avoid or manage production and to extend the productive life of wells. Also, the effects of reservoir depletion and injection can be predicted to enable optimal exploitation that avoids excessive reservoir damage, casing collapse, and hazards related to leakage of produced or injected fluids and finally fracture and fault stability.

Modeling natural fractures/faults, their characterization, and the effect of injection/production have become one of the important subjects in oil and gas field management. This issue is critical in carbonate reservoirs with a wide variety of natural fractures and faults. The complexity of fluid behavior in carbonate porous media and their characteristic parameters (such as location, pattern, direction, azimuth, magnitude, length, and aperture by core data and special log; image log and shear sonic logs) must be estimated at beginning and during of field development. However, none of these parameters are well constrained by available static and dynamic data (for example different kinds of log data, geophysical data, and reservoir data). This study concentrates on a specific parameter: fracture/fault characterization, its integration with prediction, and injection into the geomechanical analysis workflow.

1.2 Background of the Study

1.2.1 1D Geomechanical study

Wellbore instability problems bring significant cost increases to drilling operations. These problems can occur in a variety of forms including stuck pipe, loss circulation, hole enlargement, unintentionally induced tensile fractures, or difficult directional control incidents. In severe conditions, wellbore instability can increase non-productive time and create simultaneous occurrences of multiple instability incidents, which potentially can lead to losing the well if they are not handled with proper mitigation.

Angelier, J., 1979, and Aadnoy and Chenevert (1987) indicated that wellbore instability is a function of imbalance in the required wellbore pressure applied and the fluid pressure in the formation, in addition to chemical interactions between the formation and the drilling or completion fluids, and interactions between these fluids and native formation fluid. Deviation and azimuth of the well also influence the wellbore stability as the stress distribution around the wellbore is dependent on the orientation of the wellbore, concerning the in-situ stresses and the hoop stresses introduced through drilling the wellbore.

Bradley (1979), and Cheatham (1984) showed that for avoiding wellbore instability problems in drilling, a proper well design needs to be developed for the formations to be drilled and completed for production, which requires an understanding of the in-situ stress state, pore pressure, and geomechanical properties of the reservoir formation. Matthewsh (1967), Eaton (1969), and Wilson and Willis (1986) proved that wellbore stability analysis is required to predict the mud weight window for new wells. Wellbore stability analysis has been previously presented in many publications.

Geomechanical analyzing and gathering essential info is a fundamental section in oil and gas field management. The entire life cycle oil and gas field development from exploration to abandonment, drilling to production, and gas injection benefits from a 1D Mechanical Eart Model (MEM) to 3D geomechanical analysis (Zoback and Moos, 1992; Bradly, 1979; Zoback et al., 2001, Zoback, 2002). The 3D Geomechanical modeling integrates open hole log data, lab tests, leak-off tests (LOT) and daily drilling data to obtain the stress characterization such as magnitudes and direction together with specific rock strength properties. This vital concept of the stress situation and characterization of different carbonate properties (limestone and dolomite) is required for selecting the best operational parameters during drilling and oil and gas production and injection.

In well planning, the 1D MEM is used to implement the well design for choosing the best well trajectory. Mud type and weight as well as the casing scheme can be selected due to the result of Mechanical Earth Model (Hamid and Zillur, 2015). Geomechanical analyses can minimize cost and risk while maximizing drilling efficiency.

1.2.2 3D Geomechanical study

Geomechanics could be addressed and understood in all oil and gas field disciplines. These 3D models prepare the benefit for well in designing and oil and gas reservoir management especially in carbonate reservoir with different kinds of ambiguities; natural fracture, giant thrust faults. In the life cycle of the field, oil production or gas injection make considerable changes in the maximum and minimum horizontal stresses which must be analysed geomechanical modeling and define the impact of these phenomena in fluid behavior.

Koupriantchik, et al. (2007) showed that 3D geomechanical modeling has become a popular and effective way to address those challenges, particularly at the reservoir scale but also at the well scale. Improvements in seismic quality, logging data, and numerical techniques mean that we have enough information to predict stresses accurately in areas away from those previously drilled.

An elegant way of performing a spatially correct depth stretch is using structural or stratigraphic grids (called structural grids hereafter). Available to many geological subsurface modeling software packages, structural grids are essentially deformable grids, capable to be aligned to reference surfaces. The alignment to key reference horizons can be proportional allowing the grid to swell or shrink according to the distance between two reference surfaces. On the other hand, the alignment can be parallel to one key surface allowing truncation by another to form e.g. an erosional surface. The concept of structural grids aims to replicate the stratigraphic layering.

Using only a few key horizon surfaces and integrating formation markers, the structural grids can, therefore, define the full structural framework, capable to receive spatially continuous properties, including those necessary for wellbore stability analyses. Rather than extracting a multitude of zonation markers for a 1D depth stretch, the entire geomechanical model is built in 3D using such a structural grid. Most techniques for this operation are well known to geologists and reservoir engineers who build stratigraphic models and use geostatistical techniques populating them in 3D with properties such as rock type, permeability, and porosity (Deutsch, 2002; Yarus, 2002).

The geomechanical model for the Valhall field, as described in by Kristiansen et al. (2010), was built to reduce the risks that are associated with the drilling of the edge zones. The model showed that the greatest number of non-standard problems associated with stress is localized in the area near the fault. The 3D Geomechanical model used to determine the trajectory of the well, which minimizes the risks of the instability of the borehole, which significantly reduces the drilling uncertainty.

Optimization of the well trajectory and well design to avoid drilling risks during well site construction is another main of 3D geomechanics output which is important in check and control the oil and gas field study (Ovcharenko and Lukin, 2016). Optimization of hydraulic fractures in carbonate reservoirs and the processes of hydrocarbons production are other serious issues that can be considered by geomechanical study. Challenging geological conditions, the complex geological structure of sediments, which is common for fields development to date, leading to the need to build complex 3D geological and geomechanical together.

Most of the field-scale method is to integrate the 1D MEM in a geology framework and make a 3D geomechanical grid from a static model throughout the field. This new model is the only representative of a related time and reservoir pressure condition that is the condition at the time which information was acquired from the wells. So, such models might not be appropriate to study the instabilities and risks associated with reservoir depletion, e.g. fault movement and casing collapse due to compaction and subsidence. The changes in the in situ stresses concerning reservoir depletion can be estimated by providing and running a Visage model in Petrel software which is coupled to the dynamic model by Eclipse software (Younessi et al., 2013).

1.2.3 Estimation of the Rock Mechanical Properties of the Fault

Estimating the rock mechanical properties of the faults is always challenging in geoscience because the direct measurement of these properties is not practical (Bayerlee, 1975). Ideally, core samples should be taken from the faulting zone and be tested for rock mechanical properties but that requires a precise sampling at the location where the well hits the fault, which in many cases is impractical. In some cases, by knowing the constituent materials of the fillings of the fault, reasonable estimations of the mechanical properties of the fault can be made. There are also indirect methods of estimating the rock mechanical properties of a fault, which can help narrow down the values to an acceptable range of uncertainty. Experimental studies on different types of rocks have been conducted, taking into account both natural and man-made fractures/faults.

1.3 Problem Statement

In oil field development, proper well planning and safe drilling operation is very important in oil and gas field development. To identify the causes of instability problems encountered in this field, a problem diagnostic procedure must be performed, which includes studying the well plans, drilling programs, daily drilling reports, and various logs for all well. Wellbore stability issues can be caused by a combination of many factors, which can be classified into controllable and uncontrollable in origin (Chatterjee,2018).

Modeling and characterization of natural fractures by geomechanics concept (1D to 3D) and stress pattern issue has recently become a high priority issue. However, in the previous method the effect of stress or strain (by dispersion analysis) never has been involved in fracture analysis, and most of the time the full field study in the carbonate reservoir suffered about this topic.

Based on a conventional full-field study, all Geoscience team never cares about the effect of fault/fracture stability analysis during oil/gas production and injection. Sometimes if the effect of the stress on the fracture/fault is ignored, the static and dynamic model will not be reliable especially in naturally fractured carbonate reservoirs with high heterogeneity. By involving the geomechanical aspect of fault/fracture stability, it can be controlled over the development process taking into account the changes in rock stress state and changes on growth hydraulic fractures and the processes of hydrocarbons production. Understanding this leads to the fact that mixing of 3D geological and geomechanical modeling based on fault/fracture tectonics becomes an integral part of the construction of static and dynamic field models (Aguilera, 2018).

Usually in conventional structural 3D modeling fault is very concerning as having an impact as a barrier or conductive in compartmentalization issue. So because of the lack of geomechanical concept, the activation of the fault during the oil or gas production never taking care of studies. However, in general, most of the geoscientist never does the comprehensive study on fault and fracture characterization and because of the complicity of this kind of feature try to determine by geophysics or well testing. Sealing or extending the capacity of the fault itself is a very modern study that can categorize in 3D Geomechanical study. One of the main output of the 3D geomechanical modelling is different horizontal and vertical stress direction and measurements which are essential in fracture and fault behaviour analysis. By investigation on stresses variation around fault and fracture due to production, it is possible to anticipate fracture and fault stability.

As mentioned in some paragraphs in this chapter, in previous researches about fault and fracture role in oil and gas full-field studies, the relationship between production and its reaction on fault and fracture was mostly ignored and this issue could be high risk in oil and gas fields developments. Currently, in this study, the effect of hydrocarbon production on fault and fracture stability and its reaction as the main purpose were studied and recommend as a new workflow in oil and gas field study (Full Field Study or Master Development Plan) to avoid spending unnecessary budgets and time.

1.4 Objectives

The main objective of this research study is to determine the causes of instability problems from drilling operation to a fault and fracture in a natural fracture reservoir by using an integrated wellbore stability analysis (1D Geomechanical study) and 3D Geomechanical study. The specific objectives of this study include:

i. To employ a 1D geomechanical modelling or 1D MEM and making a wellbore-stability model incorporating the effects of Geomechanical properties to reduce the uncertainties in drilling operation. 1D MEM models were used for making 3D geomechanical model.

ii. To model natural fractures and faults by using the concept of Geomechanics (1D to 3D) and stress pattern analysis in carbonate reservoir

iii. To analyse the fault and fracture stability analysis during oil production and injection in natural factorized carbonate reservoir with high heterogeneity

iv. To characterize the fault in a structural study by the concept of stress and strain relationship and capacity of reactivation of the faults in a complex carbonate reservoir.

By carrying out this study it is hoped that to have a better understanding in geomechanical characteristic such as integrity stress analysis (direction and magnitude of stresses and its reaction by production/injection) of the field, which can be utilized for future developments in the field as well as improving oil and gas production, reducing the cost and time of drilling operation, minimizing the reservoir damage and finally improving reservoir management practically.

1.5 Scope

The goal of this work is to build 3D geomechanical modeling on fault/fracture stability analysis in a complex carbonate reservoir. To achieve these objectives, four tasks have been defined. The first task is building 1D geomechanical wellbore stability analysis. To do this task need to collect all necessary well and log data. Estimation shear sonic logs, mechanical parameters, and safe mud window are the main outputs in this step. In this phase, it needs to do formation evaluation regarding Lithology, effective porosity, and water saturation estimation. The second task is developing and validation of 3D geomechanical modeling. The generation of a 3D static model including the initial pore pressure model is necessary to input data that must be done by Petrel software. All 1D geomechanical results must be distributed in a static model. Mechanical parameter propagation is the final output in the second step. The third task is fracture analysis with the concept of stress and strain relationship developing by image log and other available data. Processing and interpretation of a different kind of image log (FMI, XRMI) and shear dipole sonic (DSI) for extracting the fracture and faults parameters are the important activity in this step. Fracture study by image log is a vital procedure that must be considered in the third step. Another task is verifying improved models for building the fault and fracture stability analysis. The Mohr's circle of stresses is the final output which considers the fault reactivation in the reservoir and cap rock.

Obviously, because of the wide range of reservoir geomechanical subjects, it is impossible to cover all aspects of this issue. For example, processing and interpretation of seismic analysis, dynamic modeling, compaction study are the topic which were not be comprised in this study. One of the important phases of this project is gathering information on the field that has been located in Middle East area. To fulfil the objectives of this research, the field in the middle east was selected.

1.6 Significance of Study

The Alpha field includes a wide verity of structural and geological complexity, such as different kinds of fractures (major, medium, minor, and hairline open fracture) and giant thrust fault. So any changes in stress and strain due to oil production or injection cause serious impact on fracture or fault behavior. This revolution could be constructive (increasing fracture aperture or length) or destructive (because of reducing fracture quality). However, monitoring the reaction of faults and fractures reaction due to gas production and injection is so important for field development. In the general field study, the effect of different depletion, and injection scenarios on stress distribution mostly is ignored and the impact of this stress turbulence on structural features is not considered. One of the different aspects of this study besides general procedures such as petrophysical study and making a static model is to include all geomechanical procedures from 1D to 3D geomechanics and finally focus on faults reactivation in the reservoir.

It tried to integrate all general approaches with the geomechanical study as a new method to optimize reservoir management.

REFERENCES

Aadnøy, B. S., Chenevert, M.E., 1987. Stability of Highly Inclined Boreholes. In Proceedings at the IADC/SPE drilling conference, New Orleans, March 15–18, SPE,16052

Aadnøy, B. S., Belayneh, M., 2004. Elasto-plastic fracturing model for wellbore stability using non-penetrating fluids. Journal of Petroleum Science and Engineering, vol. 45, no. 3-4, pp. 179–192.

Ali, A. H. A., Brown, T., Delgado, R., Lee, D., Plumb, D., Smirnov, N., Marsden, R., Prado-Velarde, E., Ramsey, L., Spooner, D., Stone, T., Stouffer, T., 2003. Watching rocks change; mechanical earth modeling. Oilfield Review 15, 22-39.

Allan, U.S., 1989. Model for hydrocarbon migration and entrapment within faulted structures. AAPG Bulletin 73, 803-811.

Anderson, R., Ingram, D., Zanier, A., 1973. Determining fracture pressure-gradients from well logs. Journal of Petroleum Technology 25(NOV):1259–1268

Angelier, J., 1979. Determination of the mean principal directions of stresses for a given fault population. Tectonophysics 56, 17-26.

Arroyo, Franco, J.L., Mercado Ortiz, M. A., De, G. S., Renlie, L., Williams, S., 2006. Sonic investigations in and around the borehole. Oilfield Review 18, 14-33.

Arthaud, F., Matte, P., 1977. Late Paleozoic strike-slip faulting in southern Europe and northern Africa: Result of a right-lateral shear zone between the Appalachians and the Urals. Geological Society of America Bulletin 88, 1305.

Asadi, M. S., Khaksar, A., Ring, M. J. and Yin Yin, K. 2016. Comprehensive Geomechanical Modeling and Wellbore Stability Analysis for Infill Drilling of High-Angled Wells in a Mature Oil Field . SPE-182220-MS. Presented at the SPE Asia Pacific Oil & Gas Conference and Exhibition held in Perth, Australia, 25–27 October.

Aydin, A., 2000. Fractures, faults, and hydrocarbon entrapment, migration and flow. Marine and Petroleum Geology 17, 797-814.

Bachmann, G. H., Grosse, S., 1989. Struktur und Entstehung des Norddeutschen Beckens – geologische und geophysikalische Interpretation einer verbesserten

Bouguer-Schwerekarte. Niedersächsische Akademie der Geowissenschaften Veröffentlichungen 2, 23-47.

Bachmann, G. H., Voigt, T., Bayer, U., von Eynatten, H., Legler, B., Littke, R., 2008. Depositional history and sedimentary cycles in the Central European Basin System. Springer, pp. 157-172.

Bagci, S., Tjengdrawira, M., Park, N., Hustedt, J., 2016. An Integrated Geomechanical Modeling and Completion Selection for Production Enhancement from Lower Tertiary Wells in GOM. OTC-26968-MS

Bahroudi and Koyi., 2004. Tectono-sedimentry framework of the Gachsaran Formation in the Zagros foreland basin. Marine and Petroleum Geology 21(10):1295-1310, DOI: 10.1016/j.marpetgeo.2004.09.001

Baihaky, M., Abdullah, B., and Syafiq B. M., 2018. Geomechanical Evaluations Coupled with Optimised Drilling Practices and Fluid Design Helped in Successful Drilling Through Coal in Offshore Peninsular Malaysia and Vietnam. OTC-28410-MS.

Baldschuhn, R., Best, G., Kockel, F., 1991. Inversion tectonics in the North-west German basin. Special Publication of the European Association of Petroleum Geoscientists 1, 149-159.

Bamford, W.E., 1976. Evolution of stresses in rock masses, as related to compressive strengths and plate tectonics, Investigation of stress in rock; advances in stress measurement. Australien Geomechanics Society, pp. 63-70.

Barton, C. A., Zoback, M. D., 1994. Stress Perturbations associated with active Faults penetrated by boreholes - possible evidence for near-complete stress drop and a new technique for stress magnitude measurement. Journal of Geophysical Research - Solid Earth 99, 9373-9390.

Barton, C., Moos, D., 2010. Geomechanical Wellbore imaging: Key to managing the asset life cycle. Dipmeter and borehole image log technology: AAPG Memoir 92, p. 81-112.

Berberian, M., 1995. Master "blind" thrust faults hidden under the Zagros folds: Active basement tectonics and surface morphotectonics: Tectonophysics. v. 2, p. 193–224.

Beydoun, Z., R., Hughes, G., W., 2007. The Red Sea—Gulf of Aden: biostratigraphy, lithostratigraphy and palaeoenvironments, Journal of Petroleum Geology 15(s3):135 – 15, DOI: 10.1111/j.1747-5457.1992.tb00959.x

Bourgoyne, A. T., Chenevert, M. E., Millheim, K. K., Young, Jr., 1991. Applied drilling engineering. SPE Textbook Series, 2

Bourne, S. J., Rijkels, L., Stephenson, B. J., Weber, A., Willemse, E. J .M., 2000. Predictive modelling of naturally fractured reservoirs using geomechanics and flow simulation. GeoArabia 6, 87-102.

Bradley, WB., 1979. Mathematical concept—Stress can predict borehole failure. Oil Gas J 77(8):92–102

Burchette, T. P. 1993. Mishrif Formation (Cenomanian-Turonian), southern Arabian Gulf: carbonate platform growth along a cratonic basin margin. In Cretaceous Carbonate Platforms (Simo, J. A. T., Scott, R. W. & Masse, J. P.), pp. 185–99. American Association of Petroleum Geologists, Memoir no. 56.

Byerlee, J. D., 1975. The fracture strength and frictional strength of Weber sandstone. https://doi.org/10.1007/BF00876528

Carpenter, B. M., Marone, C., Saffer, D. M., 2011. Weakness of the San Andreas Fault revealed by samples from the active fault zone. Nature Geoscience 4, 251-254.

Chanchani, S. K., Zoback, M. D., Barton, C., 2003. A case study of Hydrocarbon transport along active faults and production-related stress changes in the Monterey Formation, California. Geological Society Special Publications 209, 17-26.

Chatterjee, S., Mahapatra, S. S., Mondal, A., 2018. An experimental study on drilling of titanium alloy using CO2 laser. Sādhanā 43(8): 131.

Colman-Sadd, S. P., 1978 .Fold development in Zagros Simple Folded Belt, southwest Iran. Bulletin of the American Association of Petroleum Geologists, Vol. 62, , pp. 984-1003.

Cui, A., Brezovski, R., Glover, K., 2013. Controls of Anisotropic In-situ Stress and Permeability in Optimization of Wells and Hydraulic Fractures for Unconventional Reservoirs: Examples from the Western Canada Sedimentary Basin, 47th US Rock Mechanics / Geomechanics Symposium, San Francisco, USA.

Cheatham Jr, J., Wellbore stability. Journal of petroleum technology, 1984. 36(06): p. 889-896.

Cundall, P.A., Strack, O. D. L., 1979. A discrete numerical model for granular assemblies. Geotechnique journal, 47-65.

Cui, A., Brezovski, R., Glover, K., 2013. Controls of Anisotropic In-situ Stress and Permeability in Optimization of Wells and Hydraulic Fractures for Unconventional Reservoirs. Examples from the Western Canada Sedimentary Basin, 47th US Rock Mechanics / Geomechanics Symposium, San Francisco, USA.

Czauner, Brigitta, Madl-Szőnyi, Judit, 2011. Integrative Characterization of Faults' Hydraulic Function in Hydrocarbon Entrapment. AAPG Search and Discovery Article #90135©2011 AAPG International Conference and Exhibition, Milan, Italy, 23-26 October 2011.

Deutsch, C. V., 2002. Geostatistical reservoir modeling. Oxford University Press. New York, 2002, 376 pages.

Donald, J. A. et al., 2015. Qualifying Stress Direction from Borehole Shear Sonic Anisotropy. ARMA 15-364

Dow, J. O., 1998. A Unified Approach to the Finite Element Method and Error Analysis Procedures. Academic Press p. 533.

Drucker, D. C., Prager, W., 1952. Soil Mechanics and Plastic Analysis or Limit Design. Quarterly of Applied Mathematics 10, 157-165.

Eaton, B. A., 1969. Fracture Gradient Prediction and Its Application in Oilfield Operations. Journal of Petroleum Technology, 21(10), 1353–1360.

Eaton, B. A., 1975. The equation for geopressure prediction from well logs. Soc. Pet. Eng. https://doi.org/10.2118/5544-MS

Ewy, (1998). Wellbore Stability Predictions Using a Modified Lade Criterion. Paper presented at the SPE/ISRM Rock Mechanics in Petroleum Engineering, Trondheim, Norway, July 1998. Paper Number: SPE-47251-MS. https://doi.org/10.2118/47251-MS

Falcon, N. L., 1974. South Iran: Zagros Mountains, Mesozoic-Cenozoic orogenic belts—Data for orogenic studies: Geological Society [London] Special Publication 4, p. 199–211.

Fleckenstein, P., Reuschke, G., Müller, B., Connolly, P., 2004. Predicting stress re-orientations associated with major geological structures in sedimentary sequences. Deutsche Wissenschaftliche Gesellschaft für Erdöl, Erdgas und Kohle e.V. (DGMK), p. 95.

Fjaer, E., Stroisz, A. M., Holt, R. M., 2013. “Elastic dispersion derived from a combination of static and dynamic measurements “ , Special Issue: New and Exciting Advances, 3 ed. Springer, Vienna, Austria, pp. 611-618.

Fordjor, C. K., Bell, J. S., Gough, D.I., 1983. Breakouts in Alberta and stress in the North American Plate. Canadian Journal of Earth Sciences 20, 1445-1455.

Fox, R. J., Bowman, M. B. J., 2010. The challenges and impact of compartmentalization in reservoir appraisal and development. Geological Society Special Publications 347, 9-23.

Fredrich, J. T., Arguello, J. G., Deitrick, G. L., de Rouffignac, E. P., 2000. Geomechanical modeling of reservoir compaction, surface subsidence, and casing damage at the Belridge diatomite field. SPE Reservoir Evaluation & Engineering 3, 348-359.

Gebhardt, U., Schneider, J., Hoffmann, N., 1991. Stratigraphic and basin-development models for the Rotliegendes of the North German Basin - Modelle zur Stratigraphie und Beckenentwicklung im Rotliegenden der Norddeutschen Senke. Geologisches Jahrbuch. Reihe A: Allgemeine und Regionale Geologie BR Deutschland und Nachbargebiete, Tektonik, Stratigraphie, Palaeontologie 127, 405-427.

Geertsma, J., 1973. Land subsidence above compacting oil and gas reservoirs. Journal of Petroleum Technology 25, 734-744.

Geert Konert, et al, 2001. “ Paleozoic Stratigraphy and Hydrocarbon Habitat of the Arabian Plate” , GeoArabia, Vol. 6, No. 3, Gulf PetroLink, Bahrain

Hamid, O., Ahmed O., Guizada, P., 2017. Reservoir Geomechanics in Carbonates. SPE-183704-MS

Hamid, O., and Zillur, R., 2015. Mechanical Properties of Carbonate Reservoir and Their Influences on Drilling and Hydraulic Fracture Modeling. SPE 172573

Hamid, O., Zillur, R., Harbi, A. K., Mohiuddin M., 2015. Geomechanicl Characterization of Hydraulic Fracture in Tight Carbonates Due to Depletion. SPE 172797

Harris, G. W., 1974. Sandbox model used to examine the stress distribution around a simulated longwall coal-face. International Journal of Rock Mechanics and Mining Sciences 11, 325-335.

Harris et al 1984. Trace Element Discrimination Diagrams for the Tectonic Interpretation of Granitic Rocks. Journal of Petrology 25:956-983, DOI: 10.1093/petrology/25.4.956

Henk, A., 2008. Perspectives of Geomechanical Reservoir Models - Why Stress is Important. Oil Gas European Magazine

Herwanger, J., Koutsableloulis, N., 2011. Seismic Geomechanics: How to Build and Calibrate Geomechanical Models Using 3D and 3D Seismic Data. EAGE Publications

Heffer, K., 2002. Geomechanical influences in water injection projects; an overview. Oil & Gas Science and Technology 57, 415-422.

Henk, A., 2005. Pre-drilling prediction of the tectonic stress field with geomechanical models. First Break 23, 53-57.

Hennings, P., Allwardt, P., Paul, P., Zahm, C., Reid, R., Alley, H., Kirschner, R., Lee, B., Hough, E., 2012. Relationship between fractures, fault zones, stress, and reservoir productivity in the Suban gas field, Sumatra, Indonesia. AAPG Bulletin 96, 753-772.

Herwanger, J., Koutsabeloulis, N. C., 2011. Seismic Geomechanics - How to build and calibrate geomechanical models using 3D and 3D seismic data, 1 ed. EAGE Publications b.v., Houten, p. 181.

Hirsch, C., 2007. Numerical Computation of Internal and External Flows: Introduction to the Fundamentals of CFD, 2 ed. Butterworth-Heinemann, p. 680.

Homberg, J. C., Hu, J. Angelier, 1997. Characterization of stress perturbations near major fault zones. Journal of Structural Geology Volume 19, Issue 5, May 1997, Pages 703-718

Jaeger, J. C., Cook, N. G. W., Zimmerman, R. W., 2007. Fundamentals of Rock Mechanics, 4 ed. Blackwell Publishing, p. 475.

James GA, Wynd JG (1965). Stratigraphic nomenclature of Iranian Oil Consortium Agreement Area. Am Assoc Petr Geol B 49: 2182–2245.

Johnston, P. F., Wachi, N., 1994. Estimation of natural fracture orientation using borehole imaging logs and vertical seismic profiles at Orcutt oil field, California, USA. Proceedings - World Petroleum Congress 14, 147-148.

Jorden J. R., Shirley, O. J., 1966. Application of drilling performance data to overpressure detection. J. Petroleum Technology, 1387-1394.

Judd, W. R., 1964. Rock stress, rock mechanics and research. Elsevier, pp. 5-51.

Karsten Fischer, 2013. Geomechanical reservoir modeling – workflow and case study from the North German Basin". Dissertation

Kharitonov, A., Pogorelova, S., Bakici, A., Antonov, A., Khomutov, A., Gazpromneft, 2015. Lost Circulation Minimization Strategy Applied While Drilling Challenging Profile Well on Salym Group of Oil Fields (Russian) // SPE 176512.

Knipe, R. J., Fisher, Q. J., Jones, G., Clennell, M.B., Farmer, B., Kidd, B., McAllister, E., Porter, J.R., White, E.A., 1997. Fault seal prediction methodologies, applications and successes, in: Mùller-Pedersen, P., Koestler, A.G. (Eds.), Hydrocarbon seals - importance for exploration and production. Elsevier, Amsterdam, pp. 15-38.

Koupriantchik, D., Hunt, S.P., Boult, P.J., Meyers, A.G., 2007. Geomechanical modelling of salt diapirs; 3D salt structure from the Officer Basin, South Australia. Special Publication - Northern Territory Geological Survey, 388-396.

Koutsabeloulis, N. C., Heffer, Kes., 1996. The Dynamic 3-D Reservoir - Both Hydraulically and Geomechanically. DOI: 10.2118/35519-MS.

Kristiansen, T.G., Plischke, B., 2010. History Matched Full Field Geomechanics Model of the Valhall Field Including Water Weakening and Re-Pressurisation. In Proceedings of the SPE EUROPEC/EAGE Annual Conference and Exhibition, Barcelona, Spain. Society of Petroleum Engineers: London, UK. p. 21.

Kunze, K. R., Steiger, R. P., 1992. Accurate in-situ stress measurements. SPE 24593. https://doi.org/10.2118/132981-PA

Lampe, C., Song, G., Cong, L., Mu, X., 2012. Fault control on hydrocarbon migration and accumulation in the Tertiary Dongying Depression. Bohai Basin, China. AAPG Bulletin 96, 983-1000.

Lee, S., 1994. Fracture Identification and Evaluation Using Borehole Imaging and Full Wave Form Logs in the Permian Basin. AAPG Bulletin 78, 497.

Lees, G. M., Falcon, N.L., 1952. The geographical history of the Mesopotamian Plains. Geographical Journal, 118, 24-39.

Letouzey, J., Sherkati, J., Mengus, M., Motiei, H., Ehsani, M., Ahmadnia, A., Rudkiewicz, J. L., 2002. A regional structural interpretation of the Zagros

Mountain Belt in northern Fars and High Zagros (SW Iran). paper presented at AAPG Annual Meeting, Houston, Tex.

Lin, W., Yamamoto, K., Ito, H., Masago, H., Kawamura, Y., 2008. Estimation of Minimum Principal Stress from an Extended Leak-off Test Onboard the Chikyu Drilling Vessel and Suggestions for Future Test Procedures. Scientific Drilling 6, 43-47.

Luo, G., Nikolinakou, M.A., Flemings, P.B., Hudec, M.R., 2012. Geomechanical modeling of stresses adjacent to salt bodies: Part 1 - Uncoupled models. AAPG Bulletin 96, 43-64.

Loutfi, G., Baslaib, S. M., Abu Hamd, M., 1987. Cenomanian stratigraphic traps in western Abu Dhabi, U.A.E. Paper SPE 15684, presented at the 5th Middle East Oil Show, Bahrain, Society of Petroleum Engineers, 1.8.Google Scholar

Mackay, F., Inoue, N., Fontoura, S. A. B., Botelho, F., 2008. Geomechanical effects of a 3D vertical salt well drilling by FEA, 42nd U.S. Rock Mechanics - 2nd U.S.-Canada Rock Mechanics Symposium, San Francisco, USA.

Maerten, L., Gillespie, P., Daniel, J.-M., 2006. Three-dimensional geomechanical modeling for constraint of subseismic fault simulation. AAPG Bulletin 90, 1337-1358.

Maerten, L., Gillespie, P., Pollard, D.D., 2002. Effects of local stress perturbation on secondary fault development. Journal of Structural Geology 24, 145-153.

Mastin, L., 1984. The development of borehole breakouts in sandstone. M.Sc. Thesis. Stanford University, p. 100.

Maugeri, L., 2012. Oil: The Next Revolution - The unprecedented upsurge of oil production capacity and what it means for the world. Discussion Paper #2012-10. John F. Kennedy School of Government, Harvard University, p. 86.

Maerten, L., Pollard, D., Gillespie, P., 2002. Effects of Local Stress Perturbation on Secondary Fault Development. Journal of Structural Geology, 24:145–153.

Macé, L., Souche, L., Mallet, J. L., 2004. 3D Fracture Network Modeling Integrating Geomechanical and Geological Data. Paper presented at the AAPG International Conference and Exhibition 2004, Cancun, Mexico, Oct. 24-27.

Maugeri, L., 2013. The Next Revolution - The unprecedented upsurge of oil production capacity and what it means for the world. Discussion Paper #2012-10. John F. Kennedy School of Government, Harvard University, p. 86.

Matthews WR, John K., 1967. How to predict formation pressure and fracture gradient. Oil Gas Journal.

Meng, Q., Zhang, M., Han, L., Pu, H., Nie, T., 2016. Effects of Acoustic Emission and Energy Evolution of Rock Specimens Under the Uniaxial Cyclic Loading and Unloading Compression. Rock Mech Rock Eng. (2016) 49:3873–3886.

Morris, A., Ferrill, D. A., Henderson, D. B., 1996. Slip-tendency analysis and fault reactivation. Geology 24, 275-278.

Morris, A. P., Smart, K. J., Ferrill, D. A., Reish, N. E., Cowell, P. F., 2012. Production-induced fault compartmentalization at Elk Hills Field, California. AAPG Bulletin 96, 1001-1015.

Mouchet J. P., Mitchell, A., 1989. Abnormal pressure while drilling. Manuals techniques 2. Boussens, France, Elf Aquitaine Editions

Munjiza, A., Owen, D. R. J., Bicanic, N., 1995. A combined finite-discrete element method in transient dynamics of fracturing solids. Engineering Computations 12, 145-174.

Natural Iranian Oil Company (NIOC), 2017. Alpha Geology Report (PEDCO NEW template).docx. p87

Nikolinakou, M. A., Luo, G., Hudec, M. R., Flemings, P. B., 2012. Geomechanical modeling of stresses adjacent to salt bodies: Part 2 - Poroelastoplasticity and coupled overpressures. AAPG Bulletin 96, 65-85.

Nikolinakou, M. A., Merrell, M. P., Luo, G., B., F. P., Hudec, M. R., 2013. Geomechanical modeling of the Mad Dog salt, Gulf of Mexico, 47th US Rock Mechanics / Geomechanics Symposium. American Rock Mechanics Association, San Francisco, USA.

Ohlmacher, G. C., Aydin, A., 1997. Mechanics of vein, fault and solution surface formation in the Appalachian Valley and Ridge, northeastern Tennessee, USA: implications for fault friction, state of stress and fluid pressure. Journal of Structural Geology 19, 927-944.

Orlic, B., 2013. Site-specific geomechanical modeling for predicting stress changes around depleted gas reservoirs considered for CO2 storage in the Netherlands. 47th US Rock Mechanics / Geomechanics Symposium, San Francisco, USA.

Orlic, B., Wassing, B. B. T., 2015. A study of stress change and fault slip in producing gas reservoirs overlain by elastic and viscoelastic caprocks, Special Issue: New and Exciting Advances. 3 ed. Springer, Vienna, Austria, pp. 421-435.

Orlic, B., Wassing, B. B. T., Geel, C. R., 2013. Field scale geomechanical modeling for prediction of fault stability during underground gas storage operations in a depleted gas field in the Netherlands. 47th US Rock Mechanics / Geomechanics Symposium, San Francisco, USA.

Ovcharenko Yu.V., 2016. Experience in 3D geomechanical modeling, based on one of the West Siberia oilfield. SPE. - 2016.

Peska, P., Zoback, M. D., 1995. Compressive and tensile failure of inclined well bores and determination of in situ stress and rock strength. Journal of Geophysical Research 100, 12,791-712,811.

Plein, E., 1995. Norddeutsches Rotliegendbecken: Rotliegend Teil II. Deutsche Stratigraphische Kommission, p. 193.

Plumb, R. A., Hickman, S. H., 1985. Stress-induced borehole elongation; a comparison between the four-arm dipmeter and the borehole televiewer in the Auburn geothermal well. Journal of Geophysical Research 90, 5513-5521.

Pollard, D. D., Fletcher, R. C., 2005. Fundamentals of Structural Geology. Cambridge University Press, p. 512.

Poppelreiter, M., Balzarini, M. A., De Sousa, P., Engel, S., Galarraga, M., Hansen, B., Marquez, X., Morell, J., Nelson, R., Rodriquez, F., 2005. Structural control on sweet-spot distribution in a carbonate reservoir: Concepts and 3-D models (Cogollo Group, Lower Cretaceous, Venezuela). AAPG Bulletin 89, 1651-1676.

Potyondy, D. O., Cundall, P. A., 2004. A bonded-particle model for rock. International Journal of Rock Mechanics and Mining Sciences 41, 1329-1364.

Rehm, B.; McClendon, R., 1971. Measurement of formation pressure from drilling data. Soc. Pet. Eng. https://doi.org/10.2118/3601-MS

Ren, N. K., Hudson, P. J., 1985. Predicting the in-situ state of stress using differential wave velocity analysis. Proceedings of the Symposium on Rock Mechanics 26, 1235-1244.

Röckel, T., Lempp, C., 2003. The State of Stress in the North German Basin. Erdöl Erdgas Kohle 119, 73-80.

Rodriguez-Herrera, A. E., S. R., Handwerger, D., Herring, S., Stevens, K., Marino, S., Paddock, D., 2013. Field-scale geomechanical characterization of the Haynesville Shale, 47th US Rock Mechanics / Geomechanics Symposium, San Francisco, USA.

Rogers, S. F., 2003. Critical stress-related permeability in fractured rocks. Geological Society Special Publications 209, 7-16.

Roth, F., Bäsler, H., Weigold, G., Fuchs, K., Palmer, J., Fleckenstein, P., 1998. Spannungsmessungen in Osteuropa – Orientierungsdaten aus Nordost-Deutschland, Weißrussland und der Ukraine, ICDP/KTB-Kolloquium, Wissenschaftliches Programm und Abstracts, Bochum, Germany.

Roth, F., Fleckenstein, P., 2001. Stress orientations found in NE Germany differ from the West European trend. Terra Nova 13, 289-296.

Rutqvist, J., 2012. Geomechanical aspects of CO2 sequestration and modeling, 12th International Congress on Rock Mechanics of the International Society for Rock Mechanics. Taylor and Francis Inc., Beijing, China, pp. 1803-1808.

Rutqvist, J., 2012. The Geomechanics of CO2 Storage in Deep Sedimentary Formations. Geotechnical and Geological Engineering 30, 525-551.

Rutqvist, J., Rinaldi, A.P., Cappa, F., Moridis, G.J., 2013. Modeling of fault reactivation and induced seismicity during hydraulic fracturing of shale-gas reservoirs. Journal of Petroleum Science and Engineering 107, 31-44.

Rutter, E. H., Hackston, A. J., Yeatman, E., Brodie, K. H., Mecklenburgh, J., May, S.E., 2013. Reduction of friction on geological faults by weak-phase smearing. Journal of Structural Geology 51, 52-60.

Sanchez M.A., Vasquez A.R., D. van Alstine, J. Butterworth, J. Garsia, R. Garmona, Poquioma W., 1999. Ramones M. Applications of Geomechanics in the Development of the Naturally Fractured Cabonates of the Mara Oeste Field, Venezuela. - SPE 54008. 8 p.

Sassi, W., Faure, J. L., 1997. Role of faults and layer interfaces on the spatial variation of stress regimes in basins: inferences from numerical modelling. Tectonophysics 266, 101-119.

Sepehr and Cosgrove, 2004. Role of the Kazerun Fault Zone in the formation and deformation of the Zagros Fold-Thrust Belt, Iran. Tectonics 24(5), DOI: 10.1029/2004TC001725

Serajian, V., Diessl, J., Bruno, M. S., Hermansson, L. C., Hatland, J., Risanger, M., Ridge Torsvik, Wintershall Norge A. S., 2016. 3D Geomechanical Modeling and Fault Reactivation Risk Analysis for a Well at Brage Oilfield, Norway. SPE-180197-MS

Stocklin, J., 1974. Possible Ancient Continental Margins in Iran. In: Burke, C.A., Drake, C.L. (Eds.), The Geology of Continental Margins. Springer Verlag, New-York, pp. 873–887.

Stunes, Sindre, 2012. Methods of Pore Pressure Detection from Real-time Drilling Data. Corpus ID: 108236062.

Suarez-Rivera, R., Handwerger, D., Rodriguez Herrera, A., Herring, S., Stevens, K., Vaaland, G.D., Borgos, H., Marino, S., Paddock, D., 2013. Development of a Heterogeneous Earth Model in Unconventional Reservoirs. for Early Assessment of Reservoir Potential, 47th US Rock Mechanics / Geomechanics Symposium, San Francisco, USA.

Talebian, Jackson, 2004. A reappraisal of earthquake focal mechanisms and active shortening in the Zagros mountains of Iran. Geophysical Journal international, Volume 156, Issue 3, March 2004, Pages 506–526,

Tamagawa, T., Pollard, D. D., 2008. Fracture permeability created by perturbed stress fields around active faults in a fractured basement reservoir. AAPG Bulletin 92, 743-764.

Terzaghi, K. V., 1923. Theoretical Soil Mechanics. John Wiley, New York, p. 510.

Townend, J., 2003. Mechanical constraints on the strength of the lithosphere and plate-bounding faults. Dissertation. Stanford University, p. 135.

Townend, J., Zoback, M. D., 2000. How faulting keeps the crust strong. Geology 28, 399-402.

Van Wees, J. D., Buijze, L., Van Thienen-Visser, K., Nepveu, M., Wassing, B. B. T., Orlic, B., Fokker, P. A., 2014. Geomechanics response and induced seismicity during gas field production in the Netherlands. Geothermics, 52, 206–219. https://doi.org/10.1016/j.geothermics. 2014.05.004

Wilson R. C., Willis D. N., 1986. Successful high angle drilling in the Stratford Field. Paper SPE 15465 presented at the 61th Annual Technical Conference Exhibition, New Orleans

Yarus, J. M., Yang, K., Kramer, K., 2002. Practical Workflows for Reservoir Modeling. Proc., Geostatistics Rio 2000, 6–17 August, ed. M. Armstrong et al. Dordrecht, The Netherlands: Kluwer Academic Publishers. 69–84.

Yielding G., Gretan P., Freeman B., 2010. Fault seal calibration; a brief review: geological society, vol 347. Special Publications, London, pp 243–255

Yoshida, C., Ikeda, S., Eaton, B., 1996. An investigative study of recent technologies used for prediction, detection, and evaluation of abnormal formation pressure in North and South America. Kuala Lumpur, Malaysia. September 9-11.

Younessi, F., Gui, R., Ngan, S., Nadzri, C., 2018. Evaluation of Reservoir Compaction and Geomechanical Related Risks Associated with Reservoir Production Using a Two-Way Coupled 3D Geomechanical Model for a Deep-Water Field in South East Asia". OTC-28227-MS

Zamora, M., Lord, D.L., 1974. Practical analysis of drilling mud flow in pipes and annuli. Soc. Pet. Eng. https://doi.org/10.2118/4976-MS

Zoback, M. D., 2007. Reservoir Geomechanics. Cambridge University Press, 449 p.

Zoback, M.D., Healy, J.H., 1992. In situ stress measurements to 3.5 km depth in the Cajon Pass scientific research borehole; implications for the mechanics of crustal faulting. Journal of Geophysical Research 97, 5039-5057.

Zoback, M.D., Moos, D., Mastin, L., Anderson, R.N., 1985. Well bore breakouts and in situ stress. Journal of Geophysical Research 90, 5523-5530.

Zoback, M.D., Townend, J., 2001. Implications of hydrostatic pore pressures and high crustal strength for the deformation of intraplate lithosphere. Tectonophysics 336, 19-30.

Zoback, M.D., Townend, J., Grollimund, B., 2002. Steady-state failure equilibrium and deformation of intraplate lithosphere. International Geology Review 44, 383-401.

Zoback, M. D., Zoback, M. L., Mount, V. S., Suppe, J., Eaton, J.P., Healy, J.H., Oppenheimer, D.H., Reasenberg, P.A., Jones, L.M., Raleigh, C.B., Wong, I.G., Scotti, O., Wentworth, C.M., 1987. New evidence on the state of stress of the San Andreas fault system. Science 238, 1105-1111.

Zoback, M.L., 1992. First- and second-order patterns of stress in the lithosphere; the World Stress Map Project. Journal of Geophysical Research 97, 11,703-728

LIST OF PUBLICATIONS

Indexed Journal

1. Abdollahian, Amirhossein, **Mehdi Tadayoni**, and Radzuan Bin Junin. "A new approach to reduce uncertainty in reservoir characterization using saturation height modeling, Mesaverde tight gas sandstones, western US basins." Journal of Petroleum Exploration and Production Technology 9.3 (2019): 1953-1961. **(Indexed by SCOPUS)**

2. **Mehdi Tadayoni**, Mahmoudreza Khalilbeyg, and Radzuan Bin Junin. "A new approach to heterogeneity analysis in a highly complex carbonate reservoir by using borehole image and conventional log data." Journal of Petroleum Exploration and Production Technology (2020): 1-17. **(Indexed by SCOPUS)**.

Indexed Conference Proceeding

1. **Mehdi Tadayoni**, Mahmoudreza Khalilbeyg, Reza Shahalipour and Radzuan Bin Junin. "Risk zonation and hazard assessment base on reservoir compaction designation in a heterogeneous carbonate reservoir" 82nd EAGE Annual Conference & Exhibition 2020: 1-10. Accepted **(Indexed by SCOPUS)**.