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EUROPEAN
ASSOCIATION OF
GEOSCIENTISTS &
ENGINEERS

4th Naturally Fractured Reservoir Workshop

**FRACTURED RESERVOIRS IN THE 21ST CENTURY...
OVERCOME THE LIMITATIONS FOR SMARTER PREDICTIONS**

11-13 FEBRUARY 2020 • RAS AL KHAIMAH, UNITED ARAB EMIRATES

- **Technical Programme**

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TECHNICAL COMMITTEE

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Bertrand Gauthier	Total
Sebastian Geiger	Heriot-Watt University
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Erika Angerer	OMV E&P GmbH

WORKSHOP OVERVIEW

In 2018, the third edition of the EAGE Workshop on Naturally Fractured Reservoirs focused on the calibration issues when characterizing and modelling these reservoirs. In this regard, the adequate use of conceptual models and appropriate multidisciplinary data was discussed in constraining our static and dynamic models. The challenges to evaluate and capture the related uncertainties were as well exposed. For this fourth edition, we would like to dedicate the workshop to future aspects of fractured reservoirs. This will be done keeping in mind all the fundamental progress achieved during the recent past in the domains of:

- Fracture mechanics
- Structural history and its impact on loading and fracturing paths
- Characterization methods for fracture distribution statistics
- Static modelling of fractured reservoir
- Development of fractured reservoir-dedicated flow simulation methods

Three main topics will be proposed for the technical sessions which will cover (1) the aspects of exploration and appraisal of fractured reservoirs, (2) the recent and future developments of fracture geology and (3) the links between the static and dynamic fractured reservoir models. For these three topics, an effort will be made to include all relevant input from new technologies and modeling methods, 3D visualization and 4D field monitoring, as well as the recent advances in managing uncertainties and risks. The idea will be to identify and evaluate possible new ways to overcome the current limitations of our workflows. In addition, opening these topics and discussions to novel sources of energy such as geothermal resources will be very much encouraged.

FIELD TRIP

Tuesday, 11 February 2020 07:00 – 17:00

Seeing the (seismically) invisible in outcrops: faults, fracture corridors and distributed fractures

Led by G. Bertotti (Delft University of Technology) and R. Lazar (GeomodL International)

The 1-Day excursion will take place in the foothills of the Northern Emirates Mountains where the lack of vegetation and recent tectonics allow for the exposure of excellent outcrops! The Northern Emirates Mountains are a mainly Tertiary fold-and-thrust belt associated with the collision between the Arabian and the Eurasian plates.

For details, please visit the event website.



OVERVIEW OF REGISTRATION FEES

REGISTERED AND PAID	FROM:	FROM:	ON-SITE
	01-19-2019 UNTIL: 19-01-2020	20-01-2020 UNTIL: 01-02-2020	
EAGE Green Member	€ 945	€ 1045	€ 1045
EAGE Bronze/Silver/Gold Member	€ 795	€ 895	€ 895
EAGE Platinum Member	€ 795	€ 795	€ 795
EAGE Student Member	€ 400	€ 450	€ 450
EAGE Green Student Member	€ 425	€ 475	€ 475
EAGE Bronze/Silver/Gold Student Member	€ 400	€ 450	€ 450
Non-member*	€ 995	€ 1095	€ 1095
Student Non-member*	€ 450	€ 500	€ 500

Please note:

*Note: The main workshop registration is inclusive of the field-trip, however, there are limited seats available and you may secure your seat once you have registered and paid for the workshop.

*Memberships are provided for Non-Member registrations and the activation will only take place after the event, between 2-3 weeks.

All fees are in Euros (€). One Euro of your total registration fee is donated to the EAGE Green Fund. Please note that all fees are subject to 5% VAT as per UAE regulations.

Please note: The deadlines are following the Local Time in the United Arab Emirates.

Members please note: To qualify for the member registration fee, your EAGE membership dues for 2020 must have been paid and confirmed. The processing time for membership applications or renewals is 10 working days.

To qualify for the reduced student registration fee:

- Students must be enrolled in a full time study programme at a recognized university or institute
- The registration must be accompanied by a copy of a student ID card and/or official proof of enrolment.

Please note: Student non-members cannot be older than 34 years of age (when registering).

The non-member fee includes EAGE membership for the remainder of 2020.

Please note that EAGE reserves the right to cancel the workshop due to low participation. In this case, payment will be refunded in full

How to Register

We recommend that you register via the online registration form on the EAGE event website (<https://eage.eventsair.com/fourth-naturally-fractured-reservoir-ws/registration>).

VENUE

Hilton Al Hamra Beach And Golf Resort, Ras Al Khaimah

Please visit the website for more information or contact Maliha (Event Manager, EAGE) mai@eage.org for more details.

Hilton Al Hamra Beach And Golf Resort

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Website: <https://eage.eventsair.com/fourth-naturally-fractured-reservoir-ws/venue>



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CONTACT

For more information on the workshop, please visit the event's website or contact the EAGE Middle East & Africa office via middle_east@eage.org or +971 4 369 3897.

TECHNICAL PROGRAMME

Oral Presentations | Wednesday 12 February

CONVENTION HALL	
08:00	Registration & Welcome Coffee
08:45	HSE Announcement
08:50	Opening Address: J. Lamarche, Aix-Marseille University & L. Bazalgette, PDO
09:00	Keynote Address: Importance of diagenesis in naturally fractured reservoirs- E. Ukar The University of Texas at Austin
Exploration and appraisal aspects of fractured reservoirs M. Welch (Danish Hydrocarbon Research & Technology Centre) & L. Bazalgette (PDO)	
09:30	NFR02 - Diffraction imaging of the Wisting Discovery - T.J. Moser ³ , L.M. Moskvil ^{2*} , E. Angerer ¹ , W. Kobusinski ⁵ , M. Pelissier ⁴ , J. Orosz ¹ ¹ OMV Exploration & Production GmbH; ² OMV (Norge) AS; ³ MGS; ⁴ IGS; ⁵ Geofizyka Torun SA
10:00	NFR03 - Characteristics and genesis of hypogenic karsts in carbonate successions: inferences for hydrocarbon and geo-thermal systems - G. Bertotti ^{1*} , P. Audra ² , A. Auler ³ , F.H. Bezerra ⁴ , S. De Hoop ¹ , R. Prabhakaran ¹ , C. Pontes ⁴ , R. Lima ⁴ ¹ Delft University of Technology; ² University Nice Sophia Antipolis; ³ Instituto do Carste/Carste Ciência e Meio Ambiente; ⁴ UFRN - Federal University Rio Grande do Norte
10:30	NFR04 - Characterising Fractured Basement Reservoirs - S. Daniels ^{1*} , R. Holdsworth ² , K. McCaffrey ² , J. Long ¹ , R. Jones ¹ , R. Walker ³ ¹ Geospatial Research; ² University of Durham; ³ University of Leicester
11:00	Coffee Break
11:20	NFR05 - Fracture sequence in folded carbonates: a long and complex history of reservoir properties - J. Lamarche ^{1*} , T. Kaci ¹ , L. Marié ¹ , P. Richard ² ¹ Aix-Marseille University; ² Shell Global Solutions International BV
11:50	NFR06 - Impact of Natural Fractures in a Predominantly Non-Fractured Carbonate field, Sabiriyah Maaddud. - P.D. Richard ^{1*} , V. Zampetti ¹ , B. Dewever ¹ , P. Schutjens ¹ , I. Hossam ² , C. Vemperala ² , C. Chen ² , B. Al Otaibi ² , N. Al Sultan ² , M. Al Ajmi ² , C. Von Winterfeld ³ ¹ Shell International E&P BV; ² Kuwait Oil Company; ³ Shell Kuwait Exploration and Production BV
12:20	NFR07 - Studies of Karst Systems in Fractured Carbonate Analogs in Brazil – Impact on Reservoir Quality - V. La Bruna ^{1*} , F.H. Bezerra ¹ , G. Bertotti ³ , F. Balsamo ² , M.R. Maia ⁴ , C. Pontes ¹ , R. Araujo ¹ ¹ Universidade Federal Do Rio Grande Do Norte; ² NEXT – Natural and Experimental Tectonics Research Group – Department of Chemistry, Life sciences and Environmental Sustainability, University of Parma; ³ Dept. Geoscience and Engineering, Delft University of Technology; ⁴ UFC
12:50	Posters Oral Presentations

Posters Session	
13:15	NFR08 - An integrated approach to interpreting 'poor' seismic in a heavily faulted reservoir - E. Angerer ^{1*} , G. Arzmüller ¹ , T. Schröckenfuchs ¹ , M. Haghighi ¹ ¹ OMV Exploration & Production GmbH
	NFR09 - Structural and sedimentary discontinuities control vuggy porosity formation - R. Araújo ^{1*} , F. Bezerra ¹ , V. La Bruna ¹ , P. Audra ² ¹ Federal University Of Rio Grande Do Norte; ² Polytech Lab EA 7498, University of Nice Sophia Antipolis
	NFR10 - Hydrothermal silicification and dolomitization in fault system, Irecê Basin (Brazil) - implication for reservoir properties - V. La Bruna ^{1*} , F. Bezerra ¹ , F. Balsamo ² , C. Menezes ¹ , G. Bertotti ³ , J. Lamarche ⁴ , P. Richard ⁵ , F. Agosta ⁶ , C. Pontes ¹ ¹ Universidade Federal Do Rio Grande Do Norte; ² NEXT – Natural and Experimental Tectonics Research Group – Department of Chemistry, Life sciences and Environmental Sustainability, University of Parma; ³ Dept. Geoscience and Engineering, Delft University of Technology; ⁴ Aix Marseille Univ, CNRS, IRD, CEREGE; ⁵ Shell Global Solutions International BV, LangeKeinweg; ⁶ Department of Science, University of Basilicata
	NFR11 - Multi-scale investigation focusing on the lineament of the Pan-African basement (Eastern Egypt). - S. Luby ^{1*} , Y. Geraud ¹ , M. Diraison ¹ , M. Wicker, L. Bertrand ¹ , C. Bossennec ¹ ¹ GeoResources
	NFR12 - Collapse structures indicate karst flow corridors in carbonate units in the Salitre Formation, Brazil - R. Maia ^{1*} , H. Bezerra ² ¹ UFC; ² UFRN
	NFR13 - Karst conduits formed along fracture corridors in anticline hinges of carbonate units: implications for reservoir quality - C. Pontes ^{1*} , F. Bezerra ¹ , G. Bertotti ² , F. Balsamo ³ , V. La Bruna ¹ , S. De Hoop ² ¹ Departamento de Geologia, Universidade Federal do Rio Grande do Norte; ² Dept. Geoscience and Engineering, Delft University of Technology; ³ Next, Natural and Experimental Tectonic Research Group, Department of Chemistry, Life, Sciences and Environmental Sustainability, University of Parma
14:00	Lunch
Recent and future developments in Fracture Geology B. Gauthier (Total), E. Angerer (OMV E&P GmbH), G. Bertotti (Delft University) & M. Meda (ENI)	
14:40	NFR14 - Bridging multi-scale data set for fracture characterization and their stress sensitivity evaluation in the near-wellbore region: Results from a novel workflow. - S. Perumalla ¹ , G. Izadi ¹ , J. Franquet ¹ , A. Ghadimipour ¹ , J. Tinnin ¹ , G. Zhunussova, C. Barton ¹ , Y. Bouzida ^{1*} , E. Cazeneuve, S. Randazzo ¹ ¹ Baker Hughes
15:10	NFR15 - Comparison of Fracture Intensity Measured in Outcrop and μCT Core Plugs in a Carbonate Reservoir Analogue - S. Kokkalas ¹ , R. Jones ^{2*} , M. Wilkinson ² , S. Daniels ² , S. Gilment ² , S. Nizamuddin ¹ Department of Geology, University of Patras; ² Geospatial Research, University of Durham; ³ ADNOC Research & Innovation Center, Khalifa University
15:40	NFR16 - Exploring the limits – Integrated drill cuttings analysis for fractured (basement) reservoirs - T. Schröckenfuchs ^{1*} , A. McGeer ² , B. Rupprecht ¹ , E. Mekonnen ¹ ¹ OMV Exploration & Production GmbH; ² OMV Middle East & Africa GmbH
16:10	Coffee Break
16:30	NFR17 - Predicting connected fracture networks: Field validation of numerical models - M. Welch ^{1*} , M. Lütjhe ¹ , S. Oldfield ¹ ¹ Technical University of Denmark
17:00	NFR18 - Syndepositional deformation of the Lastoni di Formin carbonate platform (Italy) from Virtual Outcrops and field studies. - R. Inama ^{1*} , N. Menegoni ¹ , C. Perotti ¹ ¹ Università Di Pavia





Posters Session	
17:30	NFR19 - Syndepositional deformation of the Lastoni di Formin carbonate platform (Italy) from Virtual Outcrops and field studies. - R. Inama ^{1*} , N. Menegoni ¹ , C. Perotti ¹ ¹ Università Di Pavia
	NFR20 - Integrated analysis of fracture corridors - S. Viseur ¹ , J. Lamarche ^{1*} , B. Gauthier ² ¹ Aix-Marseille University; ² TOTAL / EP/DSO/GIS/TGK
	NFR23 - Fracture recognition with U-net and pixel-based automatic fracture detection - W. Zhu ^{1*} , S. Khirevich ¹ , T. Patzek ¹ ¹ King Abdullah University of Science and Technology
18:10	Close of Day
19:30	Workshop Dinner

Oral Presentations | Thursday 13 February

CONVENTION HALL	
08:30	Keynote Address: Diffuse fractures: So what? - A. Lavenu ADNOC Offshore
From static fracture models to dynamic simulation: what matters? P. Richard (Shell), J. Lamarche (Aix-Marseille University), L. Bazalgette (PDO) & T. Finkbeiner (KAUST)	
09:00	NFR25 - A novel way to decipher field performance in a NFR carbonate field - P. Olivier ^{1*} ¹ Petroleum Development Oman
09:30	NFR26 - Role of basement inherited structural network on heat distribution and flow pathways in rift basins - C. Bossennec ^{1*} , Y. Géraud ¹ , L. Bertrand ¹ , R. Divies ² , C. Souque ² , L. Mattioni ³ , I. Moretti ^{4,5} ¹ Université de Lorraine, GeoRessources; ² IFPEN; ³ Neptune Energy; ⁴ UPPA, E2S; ⁵ Sorbonnes Universités
10:00	Coffee Break
10:20	NFR27 - Investigation of modeling options for numerical simulation of fractured and karstified reservoirs - M.V. Machado ^{1*} , F. Quadros ¹ , D. Brito ¹ , R. Moraes ¹ ¹ Petrobras

10:50	NFR28 - Interplay of heat transport and fracture aperture in fractured reservoirs - L.F.L. Torres ¹ , S. Salimzadeh ² , H.M. Nick ^{1*} ¹ Technical University of Denmark; ² Commonwealth Scientific and Industrial Research Organisation (CSIRO)
11:20	Discussion
11:50	Posters Oral Presentations
Posters Session	
12:00	NFR29 - Simulation of Fracture Matrix Transfer at the Saturation Front - S. Matthai ^{1*} ¹ University of Melbourne
	NFR30 - The Interplay between Fracture Apertures and Critical Stresses in a Naturally Fractured Carbonate Reservoir in Saudi Arabia - O.E. Meza Camargo ¹ , K. Olvera Carranza ^{1*} ¹ Saudi Aramco
	NFR31 - Critically Stressed Fractures and Their Contribution to Flow – Coal Bed Methane Case Study - J. Dudek ^{1,2} , M. Kepinski ^{1,2*} , D. Podsobinski ^{1,2} , P. Ryder ¹ ¹ Polish Oil and Gas Company, Exploration and Production Branch, Warsaw, Poland; ² AGH University of Science and Technology, Faculty of Drilling, Oil and Gas, Krakow, Poland
12:45	Lunch
13:25	NFR32 - Oman's thinnest oil column produced so far in a naturally fractured reservoir under GOGD - C. Volery ^{1*} , L. Bazalgette ¹ , S. Shuaibi ¹ , F. Aljiroudi ¹ , I. Kobenko ¹ , P. Almeida ¹ , A. Zahibi ¹ , S. Omairi ¹ , H. Sukaity ¹ , M. Gharbi ¹ ¹ Petroleum Development Oman
13:55	NFR33 - Numerical Study of Fractured Reservoirs: Hydromechanical Analysis of the Permeability Tensor - A. Cardona ^{1*} , T. Finkbeiner ¹ , J.C. Santamarina ¹ ¹ King Abdullah University Of Science And Technology (KAUST)
14:25	NFR34 - From static evidence to dynamic reality: the role of diffuse fractures - O. Pippi ^{1*} , A. Lavenu ¹ ¹ ADNOC Offshore
14:50	Coffee Break
15:10	Discussion
15:45	Closing Address: J. Lamarche, Aix-Marseille University & L. Bazalgette, PDO
16:00	Close of Day



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