The 29th Formation Evaluation Symposium of Japan
Special Session: DX (Digital Transformation)
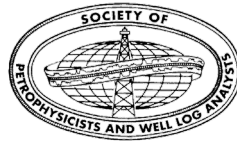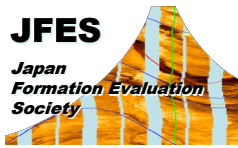## Technical Program

General schedule

September 12, 2024

9:00-17:10	Day-1 Symposium & General meeting Venue: JOGMEC-Technology & Research Center 1-2-2 Hamada, Mihama-ku, Chiba-shi, Chiba
18:00 – 20:00	30th Anniversary Banquet Venue: The Manhattan Hotel 2-10-1 Hibino,Mihama-ku Chiba-shi,Chiba

September 13, 2024

9:00-17:00	Day-2 Symposium Venue: JOGMEC-Technology & Research Center

Sponsored by	Japan Formation Evaluation Society – A Chapter of SPWLA
Cosponsored by	Technology & Research Center, Japan Organization for Metals and Energy Security
Supported by	Japanese Association for Petroleum Technology Society of Exploration Geophysicists of Japan Society of Petroleum Engineers, Japan Section The Geothermal Research Society of Japan

Sponsors

September 12th

8:30 –	**Registration**

Opening

9:00 - 9:05	**Opening and Safety Briefing**
	Yoshinori Sanada (Vice president of technology of JFES)
9:05 - 9:10	**Opening Address**
	Masatoshi Nishi (President of JFES; INPEX CORPORATION)

Technical Session 1

Chairperson:	Chair: Yuki Maehara (SLB), Co-Chair: Taisuke Mizunaga (MOECO)
9:10 - 9:50	**Invited talk 1 (online)**
	Domain based AI to accelerate subsurface decision making
	Ashwin Venkatraman (Resermine)
9:50 – 10:10 -A-	**Application of Bagging Ensemble Machine Learning Models to Predict Porosity of Sandstone Formations Using Well Log Data**
	Kushan Sandunil (Curtin University Malaysia)
10:10 – 10:30 -B-	**Learnings from 10 Years of Applications of a Probabilistic Approach to Subsurface Modelling - Impact of Ensemble Modelling in Digital Transformation**
	Sylvain Ducroux (Halliburton Landmark Reservoir Centre of Excellence)

Break

Technical Session 2

Chairperson:	Chair: Tomomi Ninomiya (SLB), Co-Chair: Takayuki Wada (WJEC)
10:40 – 11:00 -C-	**Application of machine learning in Downhole CO2 measurement using Formation Tester**
	Nishant Kumar (Halliburton)
11:00 – 11:20 -D-	**Geomodelling for CCS: a bridge too far?**
	Lazar Raffik (GeomodL International)
11:20 – 11:40 -E-	**RPM-based petrophysical chacterization of a depleted gas reservoir using the Adaptive Stiff Sand Model (ASSM) for possible CCUS applications**
	P. H. Giao (PetroVietnam University)
11:40 – 12:00 -F-	**Machine Learning-Based Classification for Mapping CO2 Presence using Seismic Data**
	Debjyoti Das (Halliburton)

Lunch

General Meeting and Keynote Address

Chairperson:	Kentaro Hasebe (INPEX)
13:00 – 13:20	**JFES General Meeting**

13:20 – 13:40	**Keynote Address (Iulian Hulea, SPWLA President)**

Break

Technical Session 3

Chairperson:	Chair: Machiko Tamaki (JOE), Co-Chair: Kenji Osawa (GERD)
13:45 – 14:05 **-G-**	**2-Dimensional Upscaling Using Deep Learning** Yuho Kodama (Waseda University)
14:05 – 14:25 **-H-**	**Development of Numerical simulator for predicting Behavior of Closed-loop Geothermal System** Rion Nakamoto (Waseda University)
14:25 – 14:45 **-I-**	**Development of Numerical Simulator Predicting Microbial Methane Generation Behavior** Risako Kawamura (Waseda University)

Break

Technical Session 4

Chairperson:	Chair: Masatoshi Nishi (INPEX), Co-Chair: Lingdan Xia (SLB)
15:00 – 15:40	**Invited talk 2** **Navigating the Frontiers: Integrating Physics-based and Data-Driven Models** Ryota Wada (The University of Tokyo)
15:40 – 16:10	**Special talk** **Contemplating Energy Issues: The History of Civilization and Our Future** Kosuke Furutachi (West Japan Carbon dioxide Storage Survey Co., Ltd.)
16:10 – 16:40	**Anniversary Address 1** **Education and Research for the New Generation in the Oil and Gas Industry (temporary)** Hisanao Ouchi (Waseda Uuniversity)
16:40 – 17:10	**Anniversary Address 2** **Pathways to a carbon neutral society and the role of formation evaluation to achieving it** Koji Yamamoto (JOGMEC)

18:00 – 20:00	**30th Anniversary Banquet** Venue: The Manhattan Hotel

September 13th

8:30 –	**Registration**

Technical Session 5

Chairperson:	Chair: Yoshinori Sanada (TAISEI), Co-Chair: Kenji Osawa (GERD)
9:00 – 9:40	**Invited talk 3 (online)** **Digitalization and AI's role in advancing subsurface capability** Judson Jacobs (S&P Global (IHS))
9:40 – 10:20	**Invited talk 4 (online)** **Deep-sensing borehole electromagnetic measurements (UDAR)** Carlos Torres-VerdinVerdin (The University of Texas at Austin)

Beak

Technical Session 6

Chairperson:	Chair: Raffik Lazar (GeomodL International), Co-Chair: Takayuki Wada (WJEC)
10:40 – 11:00 **-J-**	**Expanding The Use of Nuclear Magnetic Resonance (NMR) And Machine Learning for Reservoir Characterization of An Offshore Gas Field – Rock Typing and Capillary Pressure Profiling** Abraham J.S. Simanjuntak (JX Nippon Oil and Gas Exploration (Malaysia) Ltd.)
11:00 – 11:20 **-K-**	**Integration of FPWD and LWD NMR Data to Derive Continuous Permeability Log** Lei Zhang (SLB)
11:20 – 11:40 **-L-**	**First Application of 2D NMR Measurements Derived Reservoir Characterization in Deep Coalbed Methane Reservoir in Sichuan Basin, China** Lingdan Xia (SLB)
11:40 – 12:00 **-M-**	**Customized Wireline Acoustic Data Acquisition and Processing at Unconsolidated Formation** Lingdan Xia (SLB)

Lunch

Technical Session 7

Chairperson:	Chair: Moe Kyaw (JAMSTEC), Co-Chair: Machiko Tamaki (JOE)
13:00 – 13:40	**Invited talk 5** **Revolutionizing Core Analysis: Early-Stage Rock Facies Definition through Unsupervised Machine Learning and Comprehensive Digital Core Logging Data** Christophe Germay (EPSLOG SA)

Beak

Technical Session 8

Chairperson:	Chair: Yasuhiro Yamada (Kyushu University), Co-Chair: Taisuke Mizunaga (MOECO)
13:50 – 14:10 **-N-**	**Improved Data-Driven Method for the Prediction of Elastic Properties in Unconventional Shales from SEM Images** Deepak Devegowda (University of Oklahoma)
14:10 – 14:30 **-O-**	**Pore system evaluation of a basaltic reservoir by comprehensive laboratory analyses** Tetsuya Yamamoto (Japan Petroleum Exploration Company)
14:30 – 14:50 **-P-**	**A novel approach to CO2 geological storage and mineralization using bio-based biodegradable chelating agents** Jiajie Wang (Tohoku University)
14:50 – 15:10 **-Q-**	**Experimental Studies on Cement Grout EOR** Yuchen Liu (Waseda University)
	Present Student Awards

Beak

Technical Session 9

Chairperson:	Chair: Kian Wei Tan (Halliburton), Co-Chair: Tsuyoki Fujii (GSC)
15:30 – 15:50 **-R-**	**Integrating The Multi-Scale 3D Measurement Acquired in Horizontal Well in Complex Early Jurassic Middle Marat Carbonate Formation** Saad A H S Alajmi (Kuwait Oil Company)
15:50 – 16:10 **-S-**	**Real-time Flowline Compressibility Changes as a Catalyst for Advanced Petrophysical Interpretation in Thin-Bedded Pay** Anton Kozlov (Dragon Oil)
16:10 – 16:30 **-T-**	**Advanced Borehole Image Displays in Crust-Mantle Transition** Chiaki Morelli (SLB)
16:30 – 16:50 **-U-**	**Importance of Logging and Digital Transformation in the Scientific Ocean Drilling** Kyaw Moe (JAMSTEC)

Closing

16:50 – 17:00	**Closing** Yoshinori Sanada (Vice president of technology of JFES)

Welcome to the JFES Symposium – 30 years anniversary!!

My name is Masatoshi Nishi from INPEX corporation. I am currently serving as a President of JFES, Japan chapter of SPWLA. Today, I am very pleased to announce that we will hold the 29th Formation Evaluation Symposium at JOGMEC TRC, Chiba-city, Japan. I would like to welcome all of you to join the symposium.

Energy Transition is inevitable, just a matter of when. At the same time, hydrocarbon energy will continue to serve as a part of energy supply, even in 2050 onwards. There is not much easy reserve left to develop. In addition, decarbonization process must be there, but economical. That is what I see.

In this situation, the importance of subsurface technical evaluations remains not just the same, but also more efficient. We need to consider all available technology to apply in the market, as well as outcome from R&Ds.

So this year, we are back to set the theme of "Digital Transformation" for this reason. There are many approaches or efforts in the world to be able utilize for our current work.

The invited speakers this time are so diverse, from academia, corporate and government agent, i.e. University of Texas – Austin, University of Tokyo, Waseda University, S&P global, WEST, JOGMEC, Resermine, EPSLOG SA and SPWLA-HQ. I hope you can enjoy the wide range of talks from respective experts in the world.

And 2024 is the 30 years anniversary for JFES. I like to thank all of people involved for our 30 years of journey. Unfortunately, we are not able to gather everyone here, but we plan to have an appreciation gathering tonight for all of you here today. Please join us later.

I also like to express my thankfulness to board members and supporting staff, who have spent dedicated time for planning, arranging, preparing and executing the event.

Lastly, I wish everyone continued success and good health. Let's Enjoy the show ahead.

Best regards,
Masatoshi Nishi
President of JFES - Japan Chapter of SPWLA
September 12, 2024

Invited Talk 1

Domain based AI to accelerate subsurface decision making
Ashwin Venkatraman (Resermine)

Abstract

AI/ML powering data driven models is becoming a key differentiation to unlock higher recoveries from existing fields as well as identify new opportunities globally. The availability of data and democratization of these advanced algorithms is changing the landscape of subsurface workflows – helping create as well as improve existing ones. We are in an exciting phase in the industry where access as well as ease of using these advanced tools is transforming decision making in organizations. ML models by themselves are not effective for particularly for subsurface, given the heterogeneities, as they end up being trending models based purely on data. More so, the use of pure ML models in reservoir engineering applications can lead to basic inability to capture the basic production declines as because these are typically embedded by physics-based models. Additionally, oil and gas reservoirs are characterized by heterogeneities and compartmentalization so that ML models, created for one part of the reservoir, are also not capable of generalizing to other parts of the reservoir.

In this talk, we present how domain led ML can overcome such shortcomings. We present several successful examples of coupling domain led reduced physics models with ML that help generalize and capture inherent physics associated with subsurface. This opens up possibilities for organizations to accelerate existing and automate subsurface workflows to transform decision making.

Biography

Dr. Ashwin Venkatraman is the Founder and CEO of Resermine, a niche award-winning oil and gas technology company (MOST Promising at OTC 2018). Dr Venkatraman and his team have pioneered hybrid models that address limitations of data-driven models. He is the recipient of the inaugural SPE International Technical Award in Data Science and Engineering Analytics at SPE ATCE 2021 held in Dubai. The award recognized his contributions to bringing hybrid workflows that combine AI/ML with traditional approaches to accelerate subsurface decision making.

Invited Talk 2
Navigating the Frontiers: Integrating Physics-based and Data-Driven Models
Ryota Wada (Associate Professor, The University of Tokyo)

Abstract

Ocean utilization presents an engineering challenge as it involves confronting nature itself. Natural phenomena are inherently irregular, and exploring uncharted territories in this field is akin to delving into the unknown. Parameters essential for leveraging engineering expertise are not precisely defined, and the data available for measurement is often limited.

To maximize the utilization of information obtained from both aspects, a promising approach involves the fusion of data-driven models and physics-based insights. This lecture will focus on drilling operations, highlighting the limitations when solely relying on physics-based simulations or machine learning. Various integrated methods will be explored, providing insights into the intersection of physics-based and data-driven approaches. The presentation will conclude by discussing future prospects in this dynamic and evolving field.

Biography

Ryota Wada is an Associate Professor in the Graduate School of Frontier Sciences at the University of Tokyo. After completing his Bachelor's and Master's degrees in School of Engineering at the University of Tokyo, he gained industry experience at Mitsubishi Corporation. Returning to academia, he earned his Ph.D. in 2010 at the University of Tokyo. Since then, he has served as a researcher dedicated to ocean technology. His research is on the statistical & data science application to ocean engineering, with focus on exploration the extremes and uncertainties.

Invited Talk 3
Digitalization and AI's role in advancing subsurface capability
Judson Jacobs (S&P Global (IHS))

Abstract

Advanced AI and digitalization solutions have been gaining traction and beginning to deliver improved performance across the upstream value chain.　Despite their reputations as early adopters of digitalization, subsurface and petrotechnical domains have been more measured in their application of these advanced tools.　In what subsurface and petrotechnical segments does the greatest value lie, how are companies pursuing these opportunities, and what are some early industry-leading examples?

Biography

Judson Jacobs is a Managing Director with S&P Global's Commodity Insights energy division.　In this role he leads the company's energy technology and innovation group, bringing together company strategies, technology and innovation developments, and government and policy perspectives to deliver insights into the current state of the industry and future directions.　Recent research includes the emergence of commercial models for carbon management, finding the balance between oil & gas and new energy, and the role of AI in enabling and accelerating the energy transition. Prior to joining S&P Global, Mr. Jacobs worked as a management consultant with the Mitchell Madison Group and held senior engineering positions with Schlumberger and Anadarko Petroleum Corporation. He earned a BSE from Princeton University and an MS in Geology from Stanford University.

Invited Talk 4

Deep-sensing borehole electromagnetic measurements (UDAR)

Carlos Torres-VerdinVerdin (The University of Texas at Austin)

Abstract

We summarize our recent algorithmic and software developments concerning the rapid modeling and inversion of borehole UDAR measurements. The algorithms are designed for their efficient implementation on multi-CPU computer clusters. Modeling is performed via a finite-volume implementation of Maxwell's equations with a self-adaptable Lebedev grid for efficient and accurate assimilation of arbitrary electrical conductivity anisotropy, operating frequency, and coplanar-coaxial transmitter-receiver couplings. Inversion is carried out using both deterministic and stochastic inversion methods which explicitly render estimates of the uncertainty of inversion results. Determinist inversion methods are implemented with gradient-based strategies where the Jacobian matrix is efficiently calculated and updated by the modeling algorithm, while stochastic inversion methods are implemented with multi-grid and multi-resolution simulating annealing procedures. The inversion method progressively increases the complexity (dimensionality) of the estimated spatial distribution of anisotropic electrical conductivity around the well trajectory in the natural sequence 0D-1D-2D-3D stemming from localized dimensionality of both measurement and model complexity. Verifications of the new rapid modeling and inversion methods are performed with both challenging synthetic models inspired by field data, and field measurements acquired in the North Sea. It is found that the inversion algorithms are efficient, stable, and reliable; they enable the automatic control of model complexity vs. measurement complexity when estimating spatial distributions of anisotropic electrical conductivity around the well trajectory.

Biography

Carlos Torres-Verdín received a BSc degree in Engineering Geophysics from the National Polytechnic Institute of Mexico, a MSc degree in Electrical Engineering from the University of Texas at Austin, and a PhD degree in Engineering Geoscience from the University of California at Berkeley in 1991. During 1991-1997, he held the position of Research Scientist with Schlumberger-Doll Research. From 1997-1999, he was Reservoir Specialist and Technology Champion with YPF (Buenos Aires, Argentina). Since 1999, he has been affiliated with the Hildebrand Department of Petroleum and Geosystems Engineering of the University of Texas at Austin, where he is currently Full Professor, holds the Brian James Jennings Memorial Endowed Chair in Petroleum and Geosystems Engineering, and conducts research on borehole geophysics, formation evaluation, petrophysics, well logging, and integrated reservoir description. Dr. Torres-Verdín is the founder and director of the Research Consortium on Formation Evaluation at the University of Texas at Austin, which has been in operation for 22 years and is currently sponsored by 19 companies. He has published over 250 refereed journal papers and over 250

conference papers, two book chapters, co-authored one book, is co-inventor of 6 U.S. patents. Dr. Torres-Verdín is recipient of the 2020 Virgil Kauffman Gold Medal from the SEG, 2019 Anthony Lucas Gold Medal from the SPE, 2017 Conrad Schlumberger Award from the EAGE (European Association of Geoscientists and Engineers), 2014 Gold Medal for Technical Achievement from the SPWLA, 2008 Formation Evaluation Award from the SPE, 2006 Distinguished Technical Achievement Award from the SPWLA, Distinguished Member of the SPE, and Honorary Member of the SEG. He also received the 2003, 2004, 2006, and 2007 Best Paper Awards in Petrophysics (SPWLA), 2020 Best Paper Award published in Geophysics, 2006 and 2014 Best Presentation Awards and the 2007 Best Poster Award by the SPWLA. Dr. Torres-Verdín has supervised 39 PhD and 47 Master's students, conducted numerous industry training courses, co-chaired several technical workshops and conference sessions, and has served as member of multiple SPE, SPWLA, and SEG committees in the past.

Invited Talk 5
Revolutionizing Core Analysis: Early-Stage Rock Facies Definition through Unsupervised Machine Learning and Comprehensive Digital Core Logging Data
Christophe Germay, EPSLOG SA

Abstract

In the evolving landscape of core analysis, the advent of continuous high-resolution, cross-disciplinary digital core logs accessible immediately upon barrel opening marks a significant advancement. This study introduces a novel approach leveraging unsupervised machine learning to amalgamate digital core logs into distinct rock facies. Case studies demonstrate that subsamples selected within each facies consistently exhibit constrained properties across geological, mineralogical, geomechanical, and petrophysical dimensions. This low variability underscores the effectiveness of the methodology in capturing the intrinsic characteristics of each individual lithostratigraphic unit.

The identification of facies characteristics and their spatial distributions within the stratigraphical column prior to the initiation of subsampling facilitates a more informed and selective approach to subsampling, thereby reducing redundancy and focusing analytical resources on the most informative segments of the core.

Furthermore, once a facies is adequately characterized by the relevant properties, the continuous, high resolution core logs enable a robust upscaling of these characteristics along the entire core length. This capability results in the generation of calibrated core logs that accurately reflect the variations of valuable properties. The accuracy and reliability of these calibrated logs are underscored by their robust applicability in coordination with wireline logs. Such seamless integration of core and wireline logs not only enhances the precision of subsurface models but also provides a solid foundation for advancing our understanding of subsurface heterogeneity.

In conclusion, the integration of continuous high-resolution core logging data through unsupervised machine learning models to define rock facies represents a disruptive shift in core analysis. This methodology not only optimizes the subsampling process but also ensures the generation of calibrated core logs that can be confidently used alongside wireline logs for comprehensive subsurface characterization. Our findings advocate for a more integrated, efficient, and accurate approach to core analysis, paving the way for future research and applications in the field of underground resource evaluation for various industry sectors.

Biography

Dr. Christophe Germay is an active figure in the field of core analysis, serving as both the co-founder and CEO of Epslog since its inception in 2005. His current endeavors are centered on the enhancement of technologies for the acquisition of high-quality core-based data and the refinement of core digitalization processes tailored for machine learning applications. Holding a Bachelor of Science degree in Physics from the University of Liège, Belgium, Dr. Germay furthered his education with a Master of Science degree in Civil Engineering from the University of Minnesota. During his tenure at the University of Minnesota, he was exposed to the innovative scratch test technology, a pioneering method in the field. His academic achievements culminated in a joint PhD from the University of Liège and the University of Minnesota, solidifying his expertise in the field and his commitment to advancing core analysis technology.

Special talk
Contemplating Energy Issues -The History of Civilization and Our Future
Kosuke Furutachi (West Japan Carbon dioxide Storage Survey Co., Ltd.)

Abstract

What does it mean to think about energy issues? By unraveling the history of the development of human civilization from the perspective of energy use, beginning with the acquisition of fire, the talk will reveal how modern society is dependent on massive energy consumption. The talk will then touch upon the scientific characteristics of energy and consider how to respond to energy issues, while exploring the nature of the debate over energy issues.

Biography

Kosuke Furutachi is the president of West Japan Carbon dioxide Storage Survey Co., Ltd., which is the Special Purpose Company among ENEOS, JX Nippon Oil and Gas Exploration, and J-Power. He graduated from the Department of Applied Chemistry, Faculty of Science and Technology, Keio University in 1994. He joined Nippon Oil Corporation (now ENEOS) and has been engaging in a wide range of oil and gas businesses from downstream to upstream. Through his work in the energy industry, he became interested in the relationship between growth of energy consumption and development of human society. Since then, he has made it his lifework to think about why humans consume so much energy and what energy means. He is the author of the best-selling "A Long Journey Concerning Energy -The History of Civilization and Our Future-", Eiji Press, 2021.

Anniversary Address 1
Education and Research for the New Generation in the Oil and Gas Industry
Hisanao Ouchi (Waseda Uuniversity)

Abstract

In recent years, oil and natural gas development is expected to gradually decline in the trend that society as a whole moves toward carbon neutrality. At the same time, however, the energy transition will not be rapid, and although forecasts vary widely, many scenarios predict that oil and natural gas will continue to be a necessary energy source for society at a certain rate for at least the next 20 to 30 years. Under these circumstances, in order to meet society's demands for both more efficient production of oil and natural gas and geological storage of emitted carbon dioxide, and to provide energy in a sustainable manner, the technology for accurately understanding subsurface fluid flow (precise reservoir modeling and quantitative evaluation through reservoir simulation), which has been developed over many years in the oil and gas development industry, will continue to be needed in the future.

Universities, as one of the institutions that can provide specialized education in energy resource development, need to continuously train engineers to solve future energy problems by communicating the necessity and importance of these technologies to students through classes, and by having students work on advanced reservoir simulation technology and various issues of carbon dioxide geological storage through research in laboratories. This presentation will consider the future role and challenges for universities in the field of underground energy.

Biography

Hisanao Ouchi is a professor in Department of Resources and Environmental Engineering at Waseda University. He worked for Japan Oil Engineering Co., Ltd. for 25 years before joining Waseda University. His research interest includes numerical simulation, IOR for both conventional and unconventional resources, CCS, and MH engineering. He holds BS and MS degrees in geosystem engineering from the University of Tokyo and a PhD degree in petroleum engineering from the University of Texas at Austin.

Anniversary Address 2
Pathways to a carbon neutral society and the role of formation evaluation to achieving it
Koji YAMAMOTO (Japan Organization for Metals and Energy Security (JOGMEC))

Abstract

To achieve a carbon neutral society and energy security simultaneously, knowledge of the Earth Crust and physical phenomena happening there is essential. All technologies and processes aimed at achieving zero emissions, such as minimizing the environmental impact of hydrocarbon production, reducing emissions of greenhouse gases (GHGs) and other pollutants from exploration and production (E&P) operations, carbon capture and storage (CCS), geotechnical surveys for renewable energies, and exploration and storage of natural hydrogen, rely on accurate information about the geology, physics, and chemistry of the Earth's crust. Formation evaluation techniques developed for oil and gas exploration can be adapted to provide this information.

While there are many similarities between E&P (Exploration and Production) and carbon-neutral technologies, there are also key differences in focus and priorities. For CCS (Carbon Capture and Storage), safety and long-term stability (over 100 years) of stored CO2 are paramount. This requires a deep understanding of geomechanics, including stress states and fault conditions, as well as CO2 trap mechanics like solubility, residual gas, and mineral trapping. Additionally, target formations for CO2 storage, especially saline aquifers, are generally shallower than oil reservoirs and can be unconsolidated or weakly consolidated, presenting unique challenges compared to traditional reservoir rocks. Formations of interests for renewables such as geothermal and offshore wind are far different. Therefore, alongside leveraging existing E&P technologies, development of new technologies specifically suited for such new fields will be necessary.

The most important difference I feel is the stakeholder of the project, because public acceptance of such new technologies are essential, and information for safety and longer-m stability should be provided to stakeholders including public.

In my talk, current strategy of Japan and ideas over key technical features focusing on the formation evaluation to realize the strategy will be presented.

Biography

Koji YAMAMOTO is the vice president of Japan Organization for Metals and Energy Security (JOGMEC) in charge of technologies of Energy Business Unit. His background is petroleum geomechanics and he has worked for several geomechanics-related projects such as borehole stability studies for oil fields in the Middle East, Southeast Asia and Japan, hydraulic fracturing simulation, and stress evaluation. He received Ph.D. degree at Tohoku University for acoustic propagation in poro-elastic media.

Carbon neutral technologies such as CCS and low carbon fuels such as

hydrogen and ammonia are current area of his interests. He was awarded as the best presentation awards of annual symposiums, Japan Formation Evaluation Society in 2005 and 2019.	