

## **Best Paper of the 19th Formation Evaluation Symposium**

The best paper was selected from 24 papers presented at the 19<sup>th</sup> Formation Evaluation Symposium held at JOGMEC-TRC on September 26-27, 2013. For this selection, Board members reviewed every paper at the last board meeting and chose the awarded paper by the voting. The testimonial will be given to the awardees at the coming JFES Symposium of this year. The awarded paper and the authors are shown below.

### **Oil-Water Relative Permeability Curves for Fractures in Granite and limestone at Different Intrinsic Permeabilities**

Keisuke Sakurai, Noriaki Watanabe, Takuya Ishibashi, Noriyoshi Tsuchiya (Tohoku University), Yutaka Ohsaki, Tetsuya Tamagawa, Masahiko Yagi (JAPEx)

Although the importance and expectation of gaining proper understandings on the performance and mechanisms of fluid flow in fracture system, not many researches on oil-water two phase relative permeability systems have not been conducted to date.

In the conventional rock matrix permeability system, oil-water two phase relative permeability has been well sorted into 3 representative types; i.e. X-type based on X model, V-type based on viscous coupling model and Corey-type based on Corey model, depending on the magnitude of intrinsic permeability.

In this research, using granite and limestone with 3 different magnitude of intrinsic permeability (10D, 40D and 100D) which assumes to represent 3 different aperture size of fracture have been used to measure oil (Decane+ in used this time)-water relative permeability at laboratory experiments. The results of laboratory measurements have then been matched with simulation results. As a result of those efforts, it has been demonstrated that oil-water relative permeability in the fracture system indicate 3 types of relative permeability as is seen in the conventional rock matrix permeability system according to the size of aperture of fracture (as represented the magnitude of intrinsic permeability). Good match have been observed with X-type and V-type in the fractures of large aperture (represented by 100D) and with Corey-type in the fractures of relatively small aperture (represented by 10D, 40D) .

Based on this research, following points have been clarified :

1. If the fractures have same size of the aperture, behaviors of oil-water relative permeability system are the same in both granite and limestone.
2. In the fractures with relatively small aperture (represented by 10D, 40D) , the magnitude of non-wetting phase relative permeability is directly proportionate to inlet capillary pressure. In other words, oil-water relative permeability is largely affected by capillarity, therefore, it seems impossible to represent oil-water relative permeability by neither X model nor viscous coupling model in such fractures.
3. On the contrary, in the fractures with relatively large aperture (represented by 100D) , the magnitude of non-wetting phase relative permeability behaves almost constant having no affect by inlet capillary pressure, therefore, either X model or viscous coupling model is expected to represent oil-water relative permeability in the fracture

If researchers could put some more effort to study extra factors such as the effect of wettability of proppants in the fractures, etc. which may be an issue in the flow of artificially fractured reservoirs like shale oil/gas in due course, it would have a chance to provide a huge advancement to identify the flow mechanism and to enable to evaluate the production performance more accurately of currently booming shale gas/oil and tight gas reservoirs in addition to naturally fractured reservoirs. This research is not only interesting but very unique and ambitious and is expected further development in the future.

(Nobuhiro Fujiki, Session Chair)

# Invitation to the 86<sup>th</sup> Chapter Meeting

We are pleased to announce that the forthcoming Chapter Meeting will be held as follows. Those who are interested in attending this meeting are asked to send an e-mail registration at [JFES-Newsletter@slb.com](mailto:JFES-Newsletter@slb.com) no later than **April 4, 2014**.

**Date & Time: Tuesday, April 16, 2014, 15:30 – 17:30**

**Venue: JAPEX Research Center, 2F Conference Room 2&3**  
1-2-1, Hamada, Mihama-ku, Chiba-city, Chiba-Pref.  
TEL: 043-275-9311, FAX: 043-275-9316

## Program:

**First talk:** AVO inversion を用いた弾性定数(YM、PR)を用いた Brittleness Index の推定

**Presenter:** 稲森 隆穂(株地球科学総合研究所探査部)

**Abstract:** 米国シェールオイルフィールドの三次元地震探査データの3つの Angle Stack データを用いて、AVO Inversion を実施し、Acoustic impedance、Shear impedance、Density を算出した。これらの結果を用い、Geomechanics を推定するために役立つ弾性定数(Young's Modulus、Poisson's ratio)を求め、更に、この二つを用いて、Rickman et al.(2008)で提案された Brittleness Index を推定する解析を実施した。AVO Inversion を用いたジオメカニクスに関するパラメータ推定について発表する。

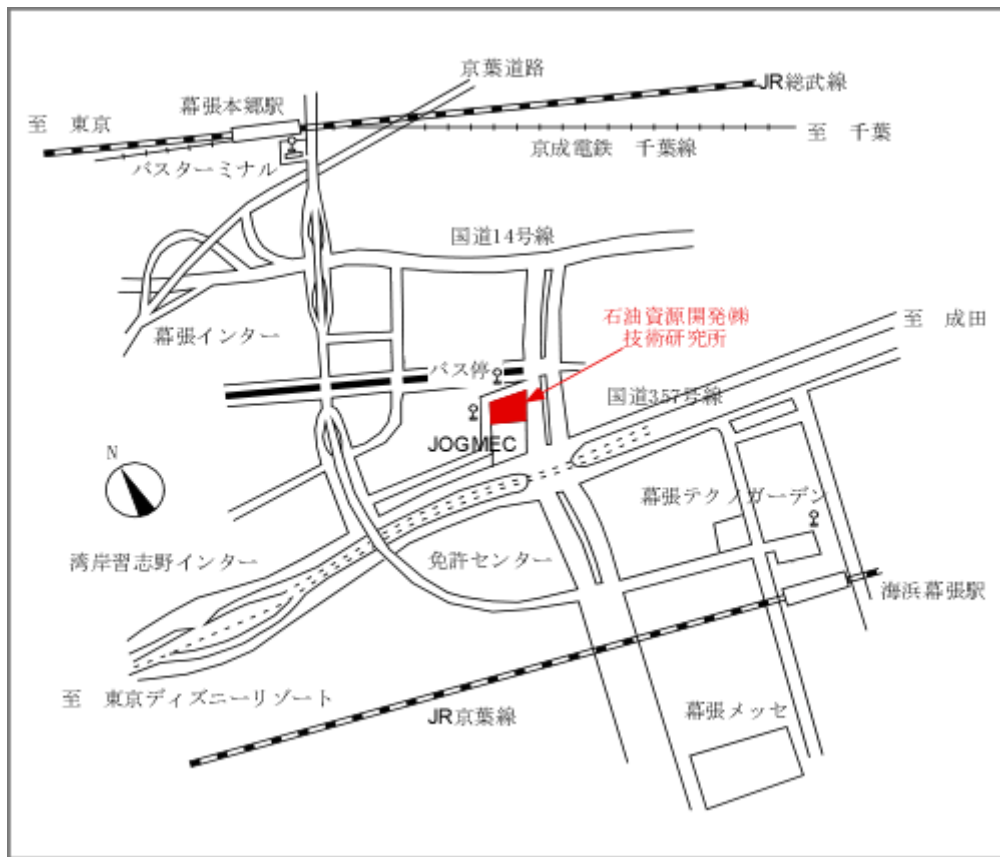
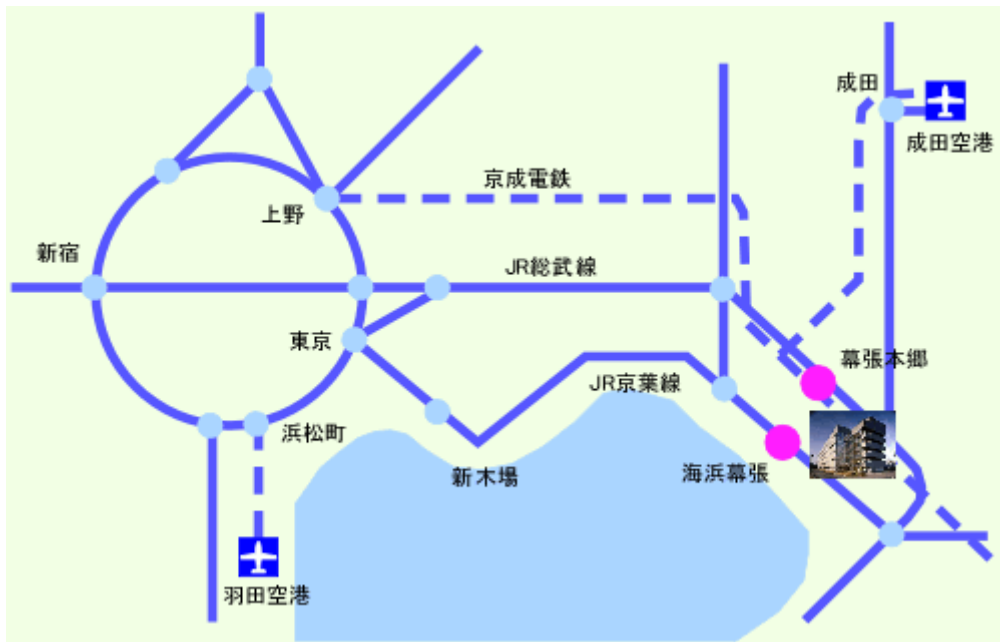
**Second talk:** ELOTによる応力評価 -原理、解析手法および国内フィールドにおける実績-

**Presenter:** 玉川 哲也、大崎 豊、手塚 和彦(石油資源開発(株)技術研究所)

**Abstract:** 石油業界における応力評価の重要性は、坑壁安定性の課題を端緒として、シェール開発におけるフラクチャリングデザインの最適化、あるいは油ガス田のフィールドドライブを通じたジオメカニクスの重要性を通して広く認識されるようになっている。

原位置における精度の高い応力評価手法としては、オーバーコアリング法などが挙げられるが、1000mを超える大深度で適用でき、且、実用性の高い手法は水圧破碎法に限定されると言える。本発表では水圧破碎法の一つであり、通常の坑井掘削作業の延長線上にある Extended LeakOff Test (ELOT)を紹介する。まず、ELOT の原理、最新の解析手法を述べ、国内の3フィールドにおける実データに基づく実績と課題を報告する。

**17:30 - 19:30 Icebreaker (1,000 yen)**



- ★ JR 総武線 幕張本郷駅 から
  - タクシーで 10 分
  - 京成バス 6 番乗場 コロンブスシティ 経由 海浜幕張駅 行き 乗車  
「浜田緑地」または「石油開発技術センター」下車
- ★ JR 京葉線 海浜幕張駅 から
  - タクシーで 10 分
  - 京成バス 3 番乗場 コロンブスシティ 経由 幕張本郷駅 行き 乗車  
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