Overview of Unconventional Oil & Gas Potentials and Exploration Activities in Japan

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<table>
<thead>
<tr>
<th>No.</th>
<th>Basin name</th>
<th>Geologic age</th>
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<td>of the bottom sediment</td>
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<td>Upper Mesozoic-Paleogene</td>
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<td>6</td>
<td>Shimajiri Basin</td>
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Siliceous Hard Shale

- Akita-Yamagata Basin has highly potential for shale oil (tight oil) and shale gas.
- Siliceous shale of Onnagawa Formation is important shale Formation.
- Equivalent or similar lithologic formations are distributed in Niigata, Okushiri, Oshima and Teshio basins.
Distribution of Onnagawa Formation
About Onnagawa Formation

- Middle to Late Miocene


Fig. 1 Paleo地理ographical map of Northeast Japan during middle to late Miocene after Ijima et al. (1988). The Onnagawa diatomaceous sediments were deposited in the central part of the N-S trending basin at an approximate bathymetrical depth of more than 500m. Both sides of the basin were limited with shallow marine (lightly dotted) and land (Heavily dotted) areas. The seven locales in this study are : 1 : Goebogawara, 2 : Ajigasawa, 3 : Noshiro, 4 : Takanosu, 5 : Oga, 6 : Gojorome, and 7 : Yashima.
About Onnagawa Formation

Isopack Map
(excluding volcanics)

Lithological Map
About Onnagawa Formation

Cross Section of Akita-Yamagata Basin
The 1st pilot test for shale oil in Japan, Operated by JAPEX and sponsored by JOGMEC

- **Ayukawa Oil-field**
  As the 1st step, we tried acid stimulation in a existing deviated hole
  - Success!

- **Fukumezawa Oil-field**
  A multi-stage hydraulic-fracturing project with a horizontal well.
Joint study with JOGMEC since 2013～2017

multi-stage fracturing in a horizontal well in FUKUMEZAWA

⇒ application of the standard technology to Japanese Monterey-type shale
Fukumezawa field

Just a five-stage fracturing in 500m horizontal section

TD=2300m
5-1/2”CSG

9-5/8”CSG

Pilot=1600m

SK-5D  SK-22D  SK-1D  SK-21  SK-23D  SK-24
Hydro-fracturing using Coiling Tube (CT)

Hydra-Jet Anchor Service: IMPROVED EFFICIENCY WITH WELLBORE DIVERSION
To further improve the efficiency of the CobraMax service, the Hydra-Jet™ Anchor enhances performance in pinpoint stimulation operations by centralizing the tool, preventing unwanted movement, and creating diversion while helping improve proppant packs of the near wellbore formation.

methoded: plug & perfo.
The 1st pilot test for shale oil in Japan, Operated by JAPEX and sponsored by JOGMEC

- **Ayukawa Oil-field**
  As the 1st step, we tried acid stimulation in a existing deviated hole
  → Success!

- **Fukumezawa Oil-field**
  A multi-stage hydraulic-fracturing project with a horizontal well. (under flow-back)
  Test was Finished in 2017 (Success?)

Current Production

  Production (1 well) : Oil : 10kl/day (62.9bbl/day)
  Gas : 2,000m³/day
Estimation of Tight Oil Reserves (after Dr. S.Yokoi, JAPEX)

- Ayukawa Area: simply 2 million bbl
- But no Commercial Product
  -> difficult to estimate proven play
- Adapting Rock-Eval Using Downey et al. (2011) Metord
GeoNavi

https://gbank.gsj.jp/geonavi/
Thank You
for your attention