AAPG International Conference
Barcelona, Spain
September 21-24, 2003

Takatoshi Namikawa[1], Masaru Nakamizu[1], Koji Ochiai[1], Yoshihiro Tsuji[1] (1) JNOC (Japan National Oil Corporation), Chiba, Japan

An Appraisal Project for Offshore Methane Hydrate in Japan

Abstract

Based on the interpretation result of many of seismic records BSR (Bottom Simulated reflector), which is considered as an index of methane hydrate, is detected in many of seismic records in offshore Japan. According to a certain trial calculation the amount of methane resource can be 250tcf in place. It is one of the largest potential hydrocarbon resources for Japan. Therefore, as a part of Japan's Methane Hydrate Exploitation Program, Japan National Oil Corporation (JNOC) has been generating an appraisal project for offshore methane hydrate. This project consists from 2D, 3D seismic and series of exploratory test wells. 2D (2800km) and 3D (1960km^2) seismic were acquired in 2001 and 2002. Exploratory test wells those will be drilled in early 2004. Data from those activities provides input data to calculate the amount of resource and information for site selection for future production test well.

Geological Setting and Distribution of BSR

Japan is located on island arc. Pacific coast (east and south) of Japan is on a forearc side, and accretionary prisms are formed offshore Pacific. Forearc basins offshore Japan has been considered as a low potential basin for hydrocarbon. Actually, most of major oil and gas fields in Japan are in backarc basins. However, large part of BSR is found in forearc side. In particular, offshore Tokai to offshore Shikoku area where are called "Nankai Trough", there are largest cluster of BSR (figure-1). Most of them are found in Pliocene to Pleistocene pelagic sediments.

Previous Activity

Since 1995, JNOC has been promoting the research consortium on methane hydrate. As a first target, offshore Tokai was chosen from points of view an existence of clear BSR, water depth, and distance from the coast. On the exploration session, high-resolution 2D seismic (1996) and "MITI Nankai Trough" exploratory test well (2000) were carried out. JNOC also joined the Mallik Consortium. Mallik 2L-38 (1998) was drilled at Mackenzie Delta, Canada, to take core samples and logging data from methane hydrate layers below permafrost. Through these activities, to identify the methane hydrate from well logging has been built up.

Summary of "MITI Nankai Trough"

"MITI Nankai Trough" was drilled at one of a forearc seamount offshore Tokai. Figure-2 shows a seismic section (NW-SE) through the well. Clear BSR are found below sea bottom and crosscut bedding planes. "This well" consists of 2 pilots hole for safety, 2 holes (main hole, post survey well -2) for coring, and 2 holes (post survey well -1, -3) for logging. Distances among each hole are 10m to 100m. These holes made clear following points.
  (1) Lower limit of methane hydrate concords to the depth of BSR on seismic.
  (2) Methane hydrate exists only in sand layers to be filled in pore spaces among grains.
  (3) Methane hydrate concentrates from lower limit of its stability zone to upward 70m.
  (4) The methane hydrate made of biogenic methane.
(2) and (4) are different from other reports on methane hydrate at Gulf of Mexico or offshore Oregon. To clarify migration and concentration mechanisms of methane hydrate or to assess methane hydrate resource unique studies would be needed.
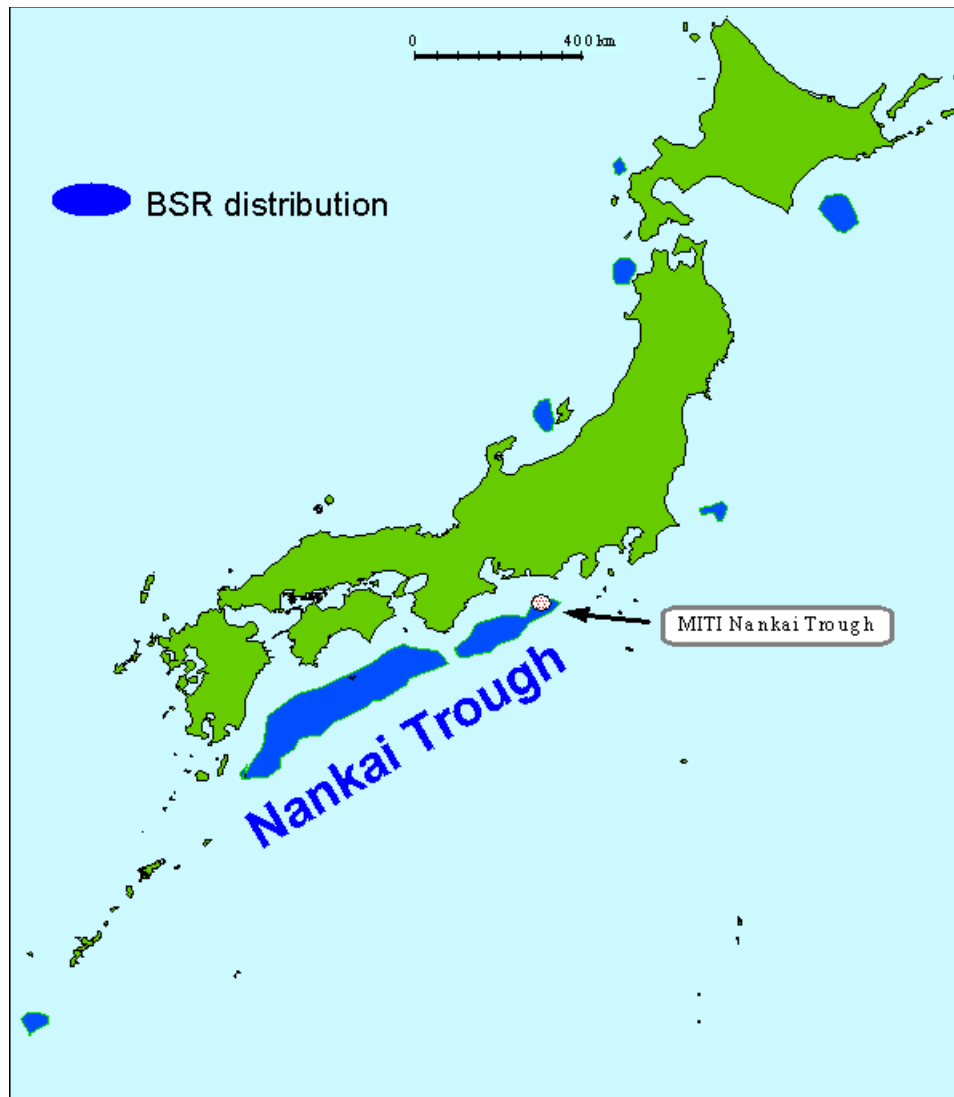
Figure-1 BSR Distribution around Japan

Figure-3 shows a schematic well correlation section of methane hydrate concentration zone. It shows a top of methane hydrate or a net pay at each well depends on an intensity of development sand layers.

"Japan's Methane Hydrate Exploitation Program"

Japan's government releases a program for methane hydrate in July 2001. First 6 years is a period to assess methane hydrate resources. "Where are", "How are", and "What amount" methane hydrate would be clarified.
To assess the resource amount, we need area of distribution, net pay, porosity, hydrate saturation, formation volume factor, and cage occupancy. Concerning to an area of distribution, we can regard it is equal to an area of BSR. Variation of the porosity around methane hydrate layers is not serious (more or less 30%). For the formation volume factor, 172 is usually used. Cage occupation is a technical term in chemistry, and more or less it would be 0.9. Therefore, remaining parameter we should get are net pay and hydrate saturation. We expect they are given from acoustic velocity anomaly on seismic. Figure-4 shows a log curve of acoustic velocity in "MITI Nankai Trough". We know the areas of excess correlates to integration of net pay and hydrate saturation. However, the correlation between
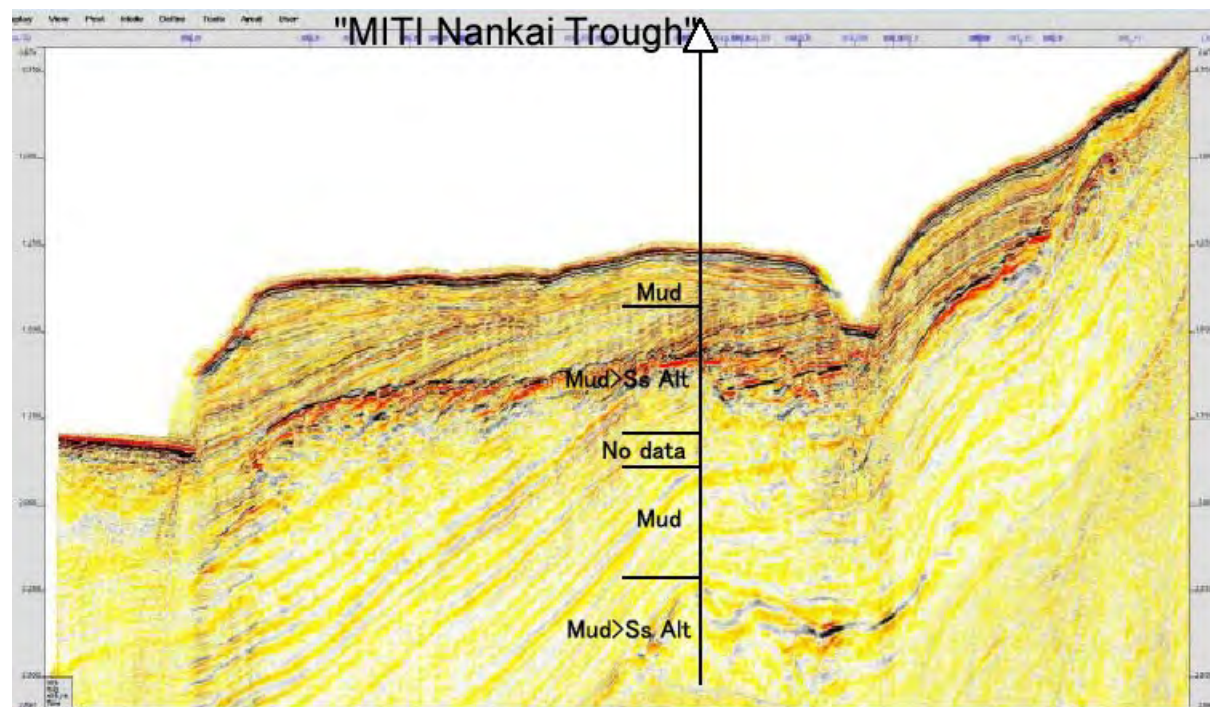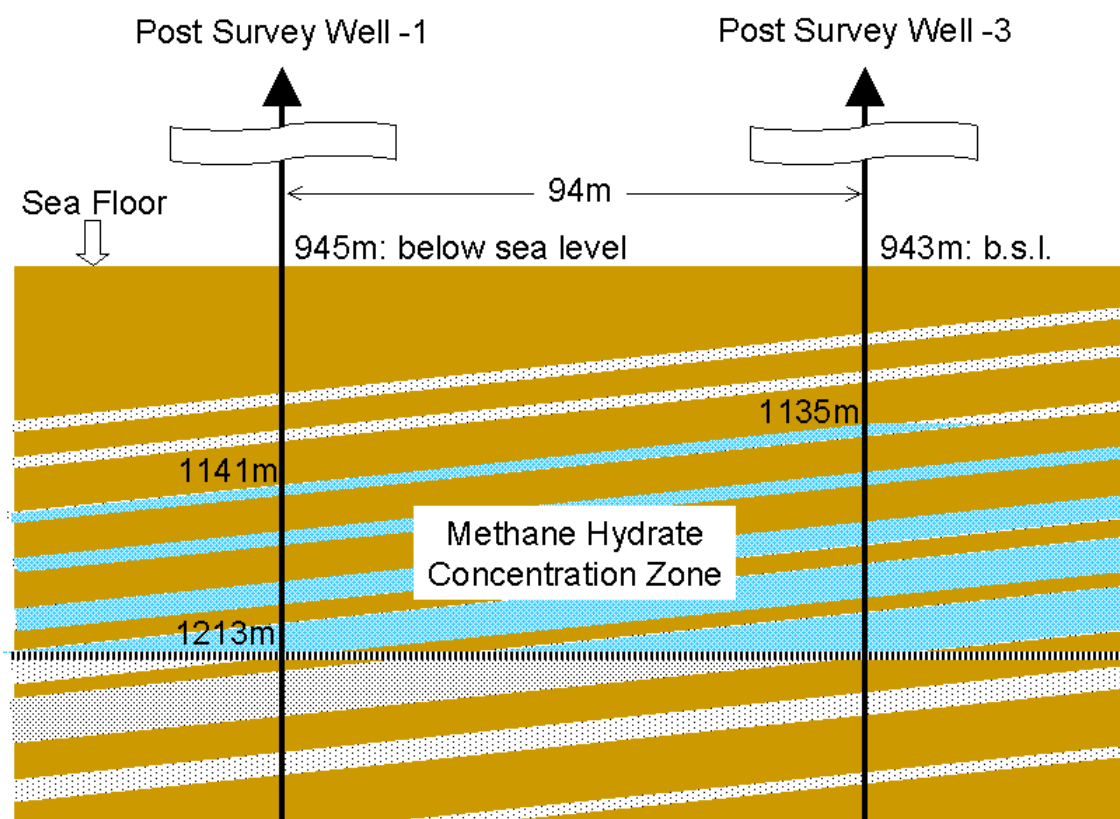
Figure-2 Seismic section through "MITI Nankai Trough"

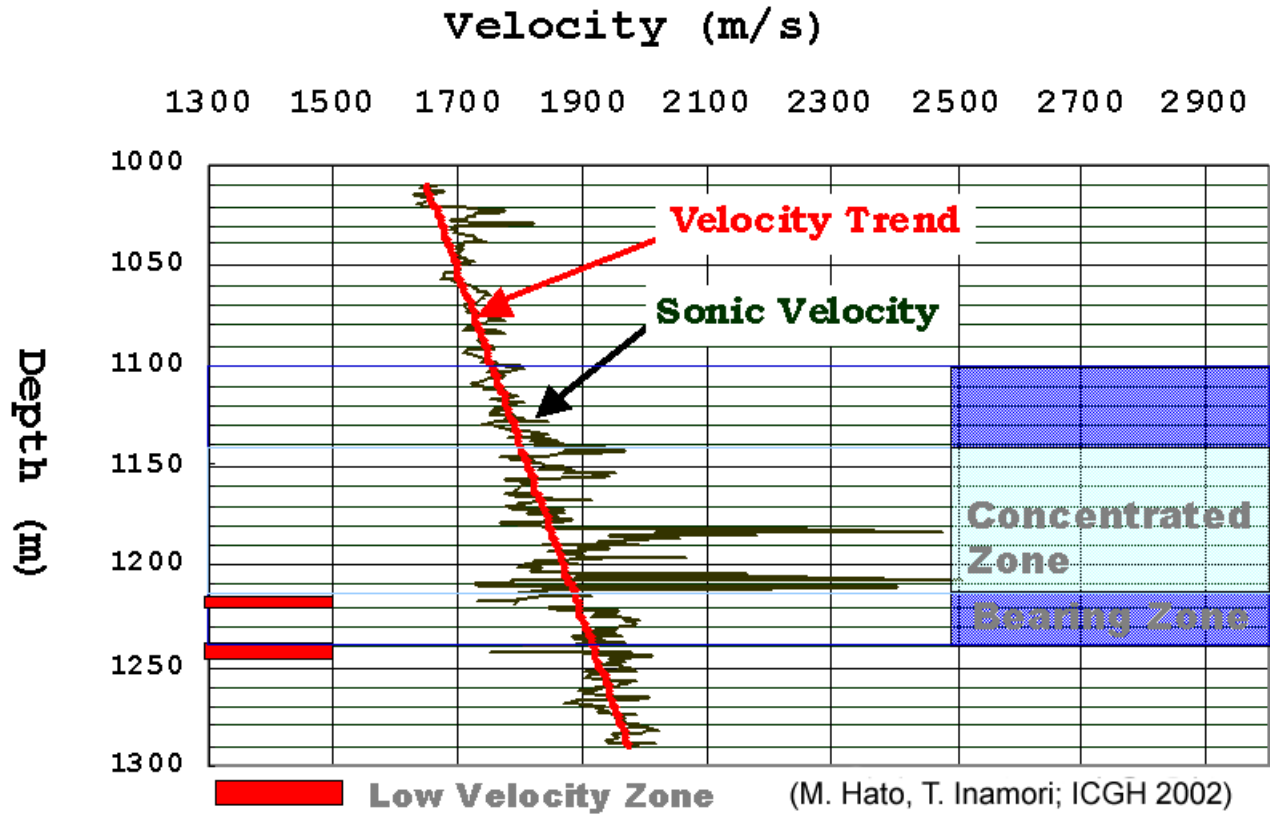**Figure-3 Methane Hydrate Concentration Zone in "MITI Nankai Trough"**

Figure-4 Acoustic velocity in "MITI Nankai Trough"

hydrate saturation and acoustic velocity may not be linear. It depends on a filling type of hydrate in pore space. This point will be next challenge.