



SEAPEX Exploration Conference 2001
Orchard Hotel, Singapore
4th – 6th April 2001

Abstract No : 3C1/2001
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GEOLOGICAL DEVELOPMENT AND HYDROCARBON PROSPECTIVITY OF THE SEA OF OKHOTSK, FAR EAST RUSSIA

The Sea of Okhotsk-Sakhalin Island area of Far East Russia is one of the world's most exciting petroleum exploration areas and offers unique opportunities for further major discoveries. Discovered resources in several giant fields on the Northeast Sakhalin Shelf (North Sakhalin Basin) total approximately three billion barrels of oil and 30 trillion cubic feet of gas.

Future exploration will be aided by a 9,800 km regional seismic survey acquired by TGS-NOPEC Geophysical Company and Dalmorneftegeofizika Trust (DMNG) during the summer of 1998. This non-exclusive 2D survey provides a regional grid of modern high quality seismic data which will help explorers better evaluate the petroleum systems in the region.

Geological evolution of the region has been complex. The area is located at a triple junction where the continental Eurasian and North American Plates meet the oceanic Pacific Plate. The sedimentary basins of the Sea of Okhotsk have evolved primarily by extensional and wrench tectonics during the Late Mesozoic and Cenozoic. Although more than 20 discrete depocentres (often referred to as "basins") are recognised, similarities are common throughout the region and most basins have a common sedimentary and structural architecture.

The prospective Cainozoic section attains a maximum thickness of 10–12 km and comprises four main successions: Paleogene, Lower Miocene, Middle-Upper Miocene and Plio-Pleistocene.

A variety of structural and stratigraphic traps are present through the basins of the region. The most prospective are structural traps associated with Miocene-Pliocene fault movements.

Localised Late Pliocene-Early Pleistocene inversion has led to the occurrence of hydrocarbon traps which are relatively small, often faulted inversion anticlines associated with the major fault zones. The inversion is responsible for the small onshore oil and gas fields which occur within strongly faulted anticlines associated with the major fault zones of Sakhalin Island and West Kamchatka.

The principal petroleum play in the region is hydrocarbons reservoired in Lower-Middle Miocene sands, sealed by intraformational muds in a structural (generally reactivated or wrench-related anticlinal) setting and sourced from the Paleogene.



Best reservoirs are associated with the palaeo-Amur delta system – gas test rates up to 160 million cubic feet per day and oil tests up to 12,000 barrels per day have been recorded.

The prospectivity of the Sakhalin Island area is well established, with offshore production having commenced. Exploration plays comprise:

- Pliocene - Miocene sands in structural trap (most common, several large structures remain undrilled);
- Oligocene fractured reservoir;
- Paleogene sands in structural and/or stratigraphic traps.

The prospectivity of the northern Sea of Okhotsk is more difficult to assess because little exploration has taken place to date (only two wells have been drilled, both probably off structure). Prominent gas chimneys visible on the new data attest to an active petroleum system.

Closures in the Magadan Basin are generally fault-bounded, long wavelength inversion related anticlines and downfaulted structural/stratigraphic traps dependent on fault seal. Potential reservoirs are likely to comprise Lower to Middle Miocene stacked fan sandstones deposited in an outer shelf to slope setting.

Potential plays include:

- L-M Miocene sands in a structural trap;
- U-M Miocene sands in a stratigraphic trap (in particular, basement onlap);
- Paleogene sands in stratigraphic and structural traps;
- Paleogene sands in structural/stratigraphic trap.