

## **Geological Conditions and Key Factors of Hydrocarbons Accumulation on North Sakhalin Offshore**

**Elena Lavrenova<sup>1</sup>, O. Zakharova<sup>2</sup>, A. Gorbunov<sup>1</sup>, M. Kruglyakova<sup>1</sup>, and I. Belenkaya<sup>2</sup>**

<sup>1</sup> SC "ASAP"

<sup>2</sup> Gazpromneft-ntc

### **ABSTRACT**

North Sakhalin shelf is one of the most HC prospective areas for oil and gas exploration in the Sea of Okhotsk. The area is relatively mature. The first offshore discoveries were made in 1970-1980 (Odoptu, Chaivo fields). To date, some large accumulations, approximately 13, were discovered offshore. 2D and 3D seismic surveys allowed delineation of a number of possible prospects having structural and stratigraphic traps. However, basin tectonic evolution and complex geology compounded the peculiarities of petroleum systems formation, leading to the low effectiveness of exploration drilling.

An integrated approach to the quantitative 3D basin modeling of the North Sakhalin shelf and adjacent areas petroleum systems were addressed in order to assess the various aspects controlling trap filling. All available datasets, from regional to detailed scales, including seismic, geochemical, micropaleontological, petrophysic data, were involved in the investigation. The work was done in two steps. The first step was the regional model building within the entire Sea of Okhotsk, while the second step was focused on the detailed modeling of the local study area.

Paleo-reconstructions identified the development of the deltaic plain and sublittoral shelf environments on the present island area during Neogene time. Marine conditions developed over the entire North Sakhalin area in the middle Miocene (Okobykai age). Upper sublittoral to upper bathyal depositional environments are evidenced by micropaleontological study.

According to the 3D modeling results, fluid type in Eastern-Shmidtovskii structural high zone depends on the HC charging system. North Sakhalin area is dominated by sediments with the high terrestrial input resulting in gas and condensate fluids in the petroleum system; while the Deryuginskii basin delivered predominantly oil type fluids. This was confirmed by C<sub>25</sub> T-shaped isoprenoid alkanes (HBI) in the oil, correlated to the diatomic source rock in the Deryuginskii basin. The reservoirs formed in Darginskii and the Lower Nutov marine formation during a time of offlapping, when the shore line had an Eastward position. The proximal and distal deltaic conditions resulted in sandy and sandy-siltstone sedimentation. High density FSST turbidites are expected to be observed in the bathyal zone.

Thereafter, 3D simulation results allowed for definition of petroleum charging systems for the East Shmidtovskii prospects and the assessment of fluid types, which are controlling factors in the prospects. The basin-fill history lead to vertical and lateral alternation of facies due to syndepositional and post-depositional tectonic movements changing the sediment transport direction. Locally eroded sediments complicate reservoir distribution prognosis. Lithostratigraphic modeling is purposed to provide additional information and support for the petroleum system predictions and will be next step of investigation.