Вывод

Таким образом, роль воды при образовании газогидратов, трудно переоценить. Вода является средой, в которой образуются газогидраты и формируются их залежи; принимает непосредственное участие в строении газогидратов, входя в состав их химических формул; отвечает за скорость образования, сохранность и разрушение залежей газогидратов.

Литература

1. Bernard B., Brooks J.M., Sackett W.M. A geochemical model for characterization of hydrocarbon gas sources in marine sediments. / Proceeding 9th Annual Offshore Technology Conference. – Houston: Off shore Technology Conference, 1977. – P. 435 – 438.
2. Chen Duofu, Xu Wenxin, Zhao Zhenhua. Gas hydrate structure and hydration numbers and its densities. / Acta Mineralogica Sinica, 2001. – №21 (2). – P. 159 – 163.
3. He Jiaxiong, Yan Wen, et al. Genetic types of gas hydrate in the world and their main controllingfactors. / Marine Geology and Quaternary Geology, 2013. – №33. – P. 121 – 126.
4. Kvenvolden K.A. A review of geochemistry of methane in nature gas hydrate. / Organic Geochemistry, 1995. – №23 (11/12). – P. 997 – 1008.
5. Kvenvolden K.A. Gas hydrate as a potential energy resource – A review of their methate content. / Howell, DG. (ed): The Future of Energy Gases, USGS Professional Paper 1570. – London: Academic Press, 1993. – P. 555 – 561.
6. Wu Houbo, Su Xiaobo,Yan Wen. The microbial genesis of submarine gas hydrate and its microbiological indication. / Marine Sciences, 2008. – №32 (3). – P. 96 – 99.

DEVELOPMENT OF OIL-AND-GAS RESOURCES OF ARCTIC SHELVES IN THE 21ST CENTURY: CHALLENGES AND PROSPECTS

N.P. Zapivalov, professor

Trofimuk Institute of Petroleum Geology and Geophysics SB RAS, Novosibirsk, Russia

Novosibirsk State University, Novosibirsk, Russia

Профессор СО РАН Н.П. Запивалов (г.Новосибирск)

КРАТКАЯ СПРАВКА

Запивалов Николай Петрович *– доктор геолого-минералогических наук, профессор, действительный член Российской академии естественных наук (РАЕН), главный научный сотрудник Института нефтегазовой геологии и геофизики СО РАН, профессор Новосибирского государственного университета, Почетный профессор Уральского государственного горного университета, Заслуженный геолог России, первооткрыватель месторождения, Лауреат межгосударственной академической премии им. академика В.А. Коптюга*

The mightiness and power of Russia will be getting accretion through Siberia and the Arctic Seas
(M.V. Lomonosov, a great Russian scientist, 1763)

At present, the population of the Earth is over 7 billion people, and it is rapidly growing. By 2050, it will reach 9 billion.

The humanity of the Earth faces three vital problems: Water, Food, and Energy.

Russia is an enormous country; its territory exceeds 17 million square km. It has inexhaustible and renewable resources of fresh water in rivers, lakes, and underground springs. This very territory is also capable of producing such a volume of food raw material that will be enough for many countries and peoples.

Now, let us consider the third (and the main) component of this life-supporting ternary – the Energy.

The basis of the energy sources is oil and gas. Of course there are also alternative sources of energy but nevertheless, in a very long-term prospect oil and gas are going to remain the key energy factors.

Nowadays Russia supplies many regions and countries with oil and gas. Still, it is not enough for the whole humanity. Where conventional oil-and-gas resources can be additionally taken?

At present, the attention of professional geologists, economists, and politicians is focused on the wealth of the Arctic and Far-East seas. It follows from the official experts' reports that the Arctic shelf of Russia is the main hope for the future.

The promising territories of the shelf exceed 6 million square km and the initial recoverable resources exceed 100 billion fuel equivalent tonnes [1].

The main difficulty in exploration and development of the Arctic natural resources is the severe natural environment; nevertheless, it is one of the most attractive oil-and-gas territories. The following countries have their exclusive economic zones in the Arctic Region: Russia, USA, Canada, Norway, Denmark, and maybe also some other countries can claim their parts. The largest territory in the Arctic Region belongs to Russia (Fig. 1).

According to «World Oil»'s editor Kurt Abraham [2], a serious problem arises now in the Arctic shelf with regard to Russia, and the stakes are very high. In his opinion, the problem involves matters of the USA national security, territorial sovereignty, shipping routes, fishing grounds and extraction of natural resources. Two members of the U.S. Congress assert that «a battle is emerging for influence in the Arctic, and that Moscow is winning».

Back in 2008, the U.S. Geological Survey (USGS) released an assessment of Arctic undiscovered, technically recoverable, conventional oil and natural gas resources. In so doing, the USGS estimated undiscovered resources for 25 Arctic sedimentary provinces. Overall, USGS estimated 412.16 Bboe of resources. Among the world's undiscovered resources, this represents 13% of the oil, 30% of the gas and 20% of the NGLs. USGS also stated that the West Siberian basin and East Barents basin hold 47% of the undiscovered resources, with 94% being natural gas and NGLs. Back in late 2013, Gazprom initiated the world's first Arctic oil production at Prirazlomnoye field, which continues to produce today. The potential in the Arctic Alaska province was estimated at 29.96 Bbbl of oil, 221.40 Tcf of gas and 5.90 Bbbl of NGLs.

Meanwhile, the significance of Arctic potential, coupled with Russian initiatives, induced the Norwegians in 2010 to hurry with making a border treaty in the Barents Sea with Moscow. Yet, there are credible rumors that the Norwegians remain highly apprehensive of Russian intentions in the Arctic, so much so that they drilled a record 14 wells in the region during 2014, including several «to plant the flag» in the southeastern portion of their jurisdiction, near the border with Russia. And this year, there are plans for a record-breaking 16 Norwegian Arctic exploration wells, including one by Statoil at the Korpfjell prospect near the Russian border. Korpfjell may hold up to 10 Bboe of resources.

Fig. 1. The Arctic shelf of the world

The opinion of experts is that the present century is going to become «a century of the Arctic Region». In the long-term prospect, a number of factors will have their effect on

the development of geo-economic, geopolitical, and ecological situation in the Arctic Region.

Let us emphasize once again that the total of the initial hydrocarbon resources in the Russian Arctic shelf is more than 100 billion fuel equivalent tonnes, 80% of which is gas. It makes more than 85% of all the hydrocarbon resources of Russia (see Fig. 2).

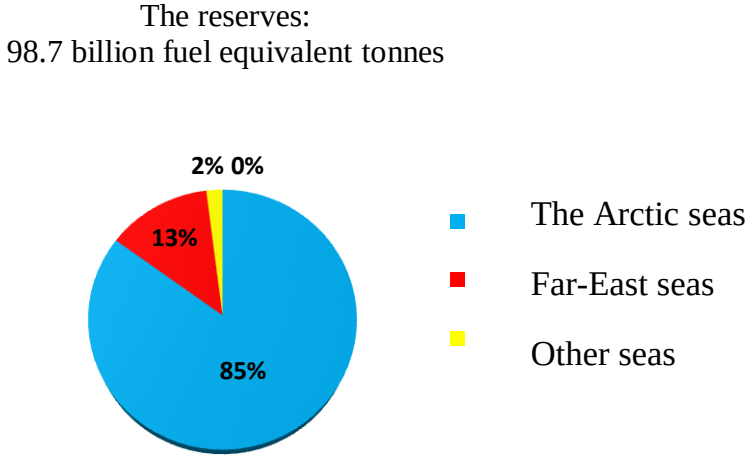

Fig 2. Under-sea reserves of Russia

In 2011, a Governmental Russian programme was adopted for developing the hydrocarbon resources of the Russian shelf, spanning until 2030. This Programme is a strategic document setting the activity trends of Gazprom Company in the Arctic Region. In realization of the shelf projects, the Programme suggests a complex approach in order to make the most efficient use of all the available technical means and infrastructure.

A stationary ice-strengthened sea platform «Prirazlomnaya» of the gravity type constructed in Russia was established at the Prirazlomnoye oilfield (Gazprom Company) in the Pechora Sea, in 60 km from the shore. For the most of the year (7-8 months) the site is covered with ice. In winter, the ambient temperature there reaches -50°C and the ice thickness is about 1.6 m. Such conditions impose special requirements on the operating company regarding the environmental safety [3].

On the 18th of April 2014, the first shipment of oil produced from this oilfield was dispatched. The first oil-tanker, of cargo capacity 70 thousand tonnes, made her way to the port of Rotterdam. Totally, 300 thousand tonnes will be exported in 2014. Oil-tankers will be dispatched from the «Prirazlomnaya» platform every 3 months.

So far, the main consumers are refineries of Great Britain, Norway, and the Netherlands.

By the way, according to the reports of the Department of Energy of the USA, oil-and-gas resources of the Arctic shelves make 22% of all the world resources.

So it is natural that cravings for the Arctic shelves keep growing. For instance, not only «Rosneft» nowadays is a leading oil-producing company in Russia but it is also a major developer of the sea shelf. At present, it is the owner of 44 licenses for developing shelf oilfields within the territory of Russia, half of which are located in the Barents Sea, Kara Sea, Chukchi Sea, and Laptev Sea.

Fig. 3. The stationary ice-strengthened sea platform «Prirazlomnaya» in the Pechora Sea, Russia

However it would be difficult for Russia alone to cope with the task of the scale exceeding that of space-exploration programmes. Russia is ready for cooperation and collaboration with any countries and oil-and-gas companies on the friendly mutually beneficial basis. It may be a large international special-purpose oil-and-gas corporation.

It is clear, therefore, that Russia is capable of supplying a considerable part of humanity with its natural wealth, provided that many countries amicably combine their efforts.

In the foreseeable future, large-scale industrial development of the purely prognostic oil-and-gas resources in Siberian Arctic seas will encounter a number of significant difficulties: insufficiency of novel technologies; financial restrictions; and natural geological hindrances. So far, there are merely plans and strategies, discussions and proposals. However the petroleum development of Arctic has undoubtful prospects.

References

1. Zapivalov N.P. Offshore oil and gas of the World. Novosibirsk State University, Novosibirsk, 2009, 260 p. (*in Rus*)
2. Kurt Abraham. U.S. concerns rise over Russian intentions in the Arctic // World Oil. – March 2017. – Vol. 238, no. 3, p.7
3. http://www.gazprom.ru/