ICAM8 Abstracts

Arctic resources

Exploration in the western Barents Sea – Future hydrocarbon potential

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For decades, the Barents Sea was considered a gas-prone province with several large gas discoveries on the Russian and Norwegian side. Significant oil-finds were unknown from Russian waters, accept for the Pechora Basin where the Fraznian - Domanik Petroleum System. The westward extension of this system is uncertain. In the Norwegian sector, exploration in the last 20 years has resulted in several oil and gas discoveries. The "Snøhvit", Goliath, Castberg, Alta / Gotha and Wising oil and gas discoveries defines the western Barents Sea as an oil and gas province.

The unique mixture of multiple petroleum systems and the existence of numerous of play-types indicate that large undiscovered oil and gas volumes exist. Due to increased geological understanding and better quality geophysical data, oil companies are better at hydrocarbon prediction but tend to overestimate volumes. A major factor is the *in depth understanding* of burial, later uplift of certain geological strata and its impact on reservoirs, maturity/migration and traps. Interestingly, several recent discoveries show that even very shallow structures can contain high quality oil. The presence of Middle/Lower Triassic petroleum systems, in addition to the classical Upper Jurassic petroleum systems, indicate that large kitchen area for exiting plays. Stratigraphic traps represent potential future targets which may be more resistive to leakage following tectonic movements and recent glacio-isostatic uplift. A large range of different plays and petroleum systems need to be explored for more oil and gas to be discovered.

Late Hercynian-Early Cimmerian ore-bearing magmatism of the Central sector of Russian Arctic

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In the northern Siberian plate of the Russian Arctic, Late Paleozoic-Early Mesozoic magmatism (granitoids and flood basalts) was widespread in Taimyr. Late Paleozoic diorite-granodiorite massifs (I-type) and stocks of mildly alkaline granites (A-type)associated with Cu and Mo, document consolidation of the Kara block at 340-256 Ma. Late Paleozoic Early Triassic flood gabbrodolerite dike swarms (249-251 Ma), Middle-Late Triassic (Early Cimmerian) ring shaped gabbro-monzonite-granosyenite and minor intrusions of latite series (231-244 Ma), and camptonite-monchikite lamprophyres, indicate intrusion into a rigid crustal block.

In the Byrranga mountains, Early Cimmerian folding is characterized by Late Permian-Early Triassic (pre-orogenic) flood basalt magmatism related to the Siberian Superplume. In Middle-Late Triassic formation of syn- and post-orogenic lavas, massifs and dikes of schriesheimite-plagioverlite-ferrogabbrodolerite-monzonites (240-245 Ma), trachyandesite-trachytes (236-245 Ma), monzodiorite-granosyenites (231-244 Ma), bostonites, lamproites, nepheline syenites, diamond-bearing alnöites (226-229 Ma) and fluid-explosive injective crustal carbonatites (219-238 Ma) was typical. This stage is connected with formation of the Fadyukuda-Kotuy “Taimyr Hot spot”.

This diverse intraplate magmatism accompanies heterogeneous mineralization: titanomagnetite, sulfide-Cu-Ni, fluorite-barite-REE, Ag-Pb-Zn, Au-bearing Cu-Mo-porphyric, Au-Sb-Hg-As. Early Cimmerian occurrences of potentially diamondiferous rocks are also likely.

Numerical simulation of permafrost-related methane hydrate reservoir of the Laptev Sea shelf

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The Laptev Sea shelf with a thick sedimentary cover is expected to have cryogenic hydrate reservoirs associated with relict permafrost. The fate of these reservoirs, with their potential to significantly increase conventional hydrocarbon resources is still poorly understood. The aim of this study is to forecast the scale and distribution character of GHSZ under simulated physical, and paleogeographic conditions for two characteristic sites in the Laptev Sea (Lena delta and Ust-Lena rift). In our study time dependent 1D thermal conductivity problem with constant heat flow at the base (60 mW/m2) and piecewise constant temperature function at top of the modeling domain (with constant temperatures during transgression-regression periods and instantaneous temperature shift in between) was solved. Simulation setup inter alia included specific heats of gas hydrate formation and ice melting. For the boundary conditions, two permafrost evolution scenarios according to Hubberten (2001) and Soloviev et al. (1987) were considered. It is allowed to compare two paleoreconstructions distinguishing by freezing time span and corresponding temperature shifts. Comparison of our modeling results with permafrost indications on seismic records (Rekant et al, 2015) allowed to groundtruthing our simulation results. The results obtained obtain a justified forecast of GHSZ distribution and evolution and estimate methane hydrate reservoir.

Poster session

Source rock geochemistry of Silurian black shales of the Eurasian Arctic

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The Silurian interval is characterised by the wide distribution of oil-prone rocks. Together, they generate ~9% of the world's petroleum reserves. These rocks are also an important source of unconventional oil and gas. However, despite their global importance there is still much basic information lacking in many parts of the world, nowhere more so than in Russia.

We provided data on the Silurian black shale distribution across the Eurasian Arctic Russia (11 regions, 28 formations) summarising their temporal and spatial distribution, as well as source rock potential (i.e. measured content of TOC).

Combined Rock-Eval and other geochemistry analyses on the Silurian samples reveal the presence of Silurian source rocks in Taimyr, Kotel'ny Island of the New Siberian Islands, northern East Siberia, northern Urals and Pai-Khoi. The most interesting targets are the Early Silurian "hot" shales of the northern East Siberia and the organic-rich shales of Severnaya Zemlya Archipelago. The occurrence of organic-rich shales in the Silurian of the northern Urals and Pai-Khoi provides an important insight into the Early Palaeozoic petroleum systems of the adjacent Timan-Pechora basin.

Mineral and gold potential of the Central sector of Russian Arctic

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The largest mineral deposits formed by the youngest tectonic Middle Mesozoic-Cenozoic cycle that divides the central Russian Arctic into mineral megaprovinces (MMP), provinces (MP), areas (MA), megazones (MMZ) and zones (MZ). These correspond to post-accretionary structural complexes and tectonic units (parts). In structure they are regional or structure-mineral provinces (SMP), which submit to tectono-mineral cycles or large geological stages. In the central Russian Arctic parts of the following largest MP are defined:

- Atlantic-Euroasian oceanic MP with Eurasic SMP potentially Cu-sulfide-bearing;
- Verkhoyano-Kolymsky fold belt (Late Cimmerian) with Khatanga-Laptev Sea Late Mesozoic-Cenozoic potentially oil-bearing SMP, Verkhoyanskaya Late Cimmerian gold-silver-polimetallic SMP;
- Arctic fold belt (Early Cimmerian) with middle Mesozoic-Cenozoic Barents Sea-North Kara, South Kara-Ust'eniseyskaya oil-bearing and Novaya Zemlya-Taimyro-Severnaya Zemlya placer gold-bearing SMP;
- Uralo-Mongolian (Hercynian) fold belt with West Siberian Early Mesozoic-Cenozoic oil and gas-bearing SMP;
- East Siberian platform with Cenozoic placer- and diamond-bearing Guly-Popigay SMP, Middle Mesozoic-Cenozoic oil and gas-bearing Khatanga-Viluy SMP, Riphean-Paleozoic oil and gas-bearing Lena-Tunguska SMP.

Indigenous gold contents of the central Russian Arctic is connected with mineralization MMZs of the Late Hercynian Kara MA and Late Cimmerian Byrranga MA which are parts of Arctic belt MP. Our predictive estimation of gold resources of these MAs is 2574 tones