Paper Number: 5106

# The Russian Arctic sedimentary basins and their prospects for hydrocarbons

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The vast Eurasian Arctic epicontinental shelf in the Russian Arctic is occupied by the Eastern Barents, Kara, Laptev, East Siberian seas and the western Chukchi Sea. This huge region consists over 40 sedimentary basins of variable size, age and genesis, which are expected to bear significant undiscovered hydrocarbon (HC) resources. Apart from the East Barents, Pechora and South Kara shelves with proven world-class oil, gas and gas condensate resources, the rest of the basins are undrilled and explored with a sparse grid of regional 2D seismic lines. Petroleum geology of these basins can only be projected from onshore outcrops, and developed models reveal significant uncertainties especially with regard to the age and stratigraphy of sedimentary successions. This imposes significant constraints on HC play models.

The Russian Arctic sedimentary basins were formed and developed as a result of orogenic collapse, back-arc extension, or intracontinental extension associated with the breakup of the Laurussia, Laurasia, Pangea and Eurasia supercontinents; some of the basins were later modified through a series of structural inversions. The underlying consolidated continental crust formed in Neoproterozoic and much of the Phanerozoic as a result of a series of collisions between the Laurentia, Baltica and Siberia continents and with a number of smaller microcontinents and/or island arc fragments. Important tectonic events controlling the structure and petroleum geology of the basins were: the Caledonian orogeny followed by Late Devonian to Early Carboniferous rifting, Late Palaeozoic Baltica/Siberia collision and Uralian orogeny, Triassic and Early Jurassic rifting, Late Jurassic to Early Cretaceous Canada Basin opening accompanied by closure of the Anyui Ocean and Verkhoyansk-Brookian orogeny, and opening of the Eurasia Oceanic Basin in Cenozoic.

The Pechora-East Barents and South Kara shelves have the largest discovered HC resources. Recent oil discovery *Pobeda* highlights the marginal zones of these basins as having higher chances for finding oil plays. The North Kara Shelf is virtually unexplored. Several mid-sized depocenters were mapped; these are inferred to be mostly of early to middle Palaeozoic in age, and are affected by inversions related to the Late Palaeozoic and Early Mesozoic orogenic events. The North Kara HC plays are unconstrained, though the main source rocks are inferred to be of Early Palaeozoic in age.

The Siberian Arctic shelves were severely affected by the Late Mesozoic (Neocomian) orogeny, which largely shaped their tectonic basement and also had a dramatic impact on their potential petroleum systems. The Laptev rift basins are filled with thick Upper Cretaceous to Cenozoic terrestrially sourced clastic sediments, and are inferred to bear large gas resources. Potential oil source rocks, if present in some parts of the rift basins, may have suffered from high heat flow and great burial depth.

The East Siberian and Chukchi shelves are dominated by two generations of basins divided by W to E-trending Late Mesozoic compressional deformation front: (1) Late Cretaceous-Cenozoic basins south of the deformation front, and (2) Late Palaeozoic (?) to Early Cretaceous basins north of the front. The HC potential of the group (1) basins is considered to be mainly gas-prone related to terrestrial sources. The

more distal basins (2) are thought to be more favourable for the oil-source presence: The North Wrangel Basin is inferred to resemble the basins of the Alaska's North Slope, and the North Chukchi Basin dominating the Russian Chukchi and the northern East Siberian Sea is a gigantic depocenter floored by the exhumed upper mantle and filled with c. 20km of mostly post-Neocomian siliciclastic sediments whose HC plays could resemble the known Late Cretaceous and Cenozoic plays of the Beaufort Sea.