Petroleum Geology of Russian Arctic Basins

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ABSTRACT

Analysis of the Russian Western Arctic basins, their structures and hydrocarbon prosepctivity shows the areas, which are favourable for hydrocarbon accumulations. All the discovered hydrocarbon resourses are located in the western part of Russian Arctic. The rest of the vast Russian Arctic Shelf is characterized by a significantly lower level of geological and geophysical study. As there has been no exploratory drilling anywhere in the East Russian Arctic, a description of hydrocarbon resource potential must draw on seismic structure and stratigraphy, and study of basins having similar geology but in a more advanced stage of exploration. Large sedimentary basins developed on intercontinental sutures through extension and collapse of the former orogenic highlands that had developed within the sutures. Thus, economic basement beneath these basins is of Caledonian, Ellesmerian and Uralian 'ages'. Stratigraphy of the Arctic basins have general similarity. The Upper Palaeozoic successions consist of intermixed carbonates and siliciclastics with sporadic occurrences of evaporites. In contrast, the Mesozoic and Cenozoic successions consist almost entirely of siliciclastics, which locally include intervals of coal-bearing strata. Transition from carbonate to clastic deposition occurred during the Permian. Widespread evaporate beds can be marked out within Carboniferous and Permian sections. The Eurasian Arctic extensional basins are filled by mainly Palaeozoic and Mesozoic sedimentary successions. Intracratonic rifting resulted in an increased heat regime in the extensional basins and oil and gas kitchens. The reservoirs can be filled by HC due to the lateral migration of fluids from the neighbouring kitchens or from their own dominant oil-and-gas source rock strata. For the formation of oil accumulations, the most favourable are platform massifs and ancient uplifts areas. Fault tectonics resulted in vertical migration of fluids. Palaeozoic and Mesozoic petroleum systems are generating and migrating hydrocarbons into the upper sedimentary successions, providing additional amounts of mainly gas hydrocarbons. Inversion caused trapping and affected fluid migration, mixing the petroleum systems. Inverted structures in the intracratonic rift basins have the highest potential for large hydrocarbon accumulations but, in highly uplifted areas affected by faulting and erosion, exploration risk is high.