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EXPLORING FROM THE SOURCE ROCK UP: A REGIONAL VIEW OF THE BARENTS AND KARA SEA PETROLEUM SYSTEMS

Erik GALIMOV[1], Alla NEMCHENKO-ROVENSKAYA[1], Vyatcheslav SEVASTYANOV[1], Chereé STOVER[2], Edith FUGELLI[2], Paul MILNER[2], Jan-Erik KITTILSEN[2], Evan HANSEN[2], Ellen BIRKELAND[2], Alexey GURYANOV[2], Steve MATTHEWS[2] and Neil PIGGOTT[2]

[1] "GEOKHI", Russia, [2] BP Exploration

The Russian Barents and Kara Seas are located offshore from the prolific onshore oil and gas provinces of Timan Pechora and Yamal Peninsula, but the hydrocarbon potential in each basin is largely unknown. A regional petroleum systems analysis was conducted from the Russian Barents to Kara Sea, in conjunction with joint studies on the tectonic evolution and paleodepositional environments of the region.

Permo-Triassic/ Triassic terrestrially-dominated source rocks and Upper Jurassic marine shales are likely the major source rocks for the hydrocarbons in Barents and Kara Sea, with secondary contribution from terrestrial to marine source rocks in the Mid-Jurassic. Prevailing shallow water conditions throughout the Triassic were favorable for deposition of Lower to Mid-Upper Triassic gas-prone paralic and lower coastal plain coals (Organofacies DE) in both Barents and Kara Sea. Bathymetry deepened into the Jurassic, with prevailing marine conditions allowing for deposition of the prolific oil-prone Upper Jurassic "Bazhenov" (Organofacies B) in Barents Sea and age-equivalent marine shales within the Kara Sea.

Although the source rock depositional environments are similar between the Russian Barents and Kara Sea, significant differences manifest in the thermal evolution of the basins and source rock quality. In the Russian Barents Sea, the oil-prone Bazhenov source is immature, and early deep burial of the Triassic resulted in much of the gas being expelled prior to trap formation. Resultantly, traps collect the mature end of expulsion from the Triassic source. In contrast, Kara Sea source rocks are interpreted to mature coeval with or post trap formation, allowing for capture of the full expulsion spectrum.

Geochemical unmixing of onshore and offshore gas data indicate a predominantly thermogenic system, with limited biogenic contribution, contrary to previous studies. Kara and Barents Sea are both expected to be thermogenic gas provinces, driven by source type, and the interaction between charge timing and trap formation.