

Migrated oil on Novaya Zemlya, Russian Arctic: Evidence for a novel petroleum system in the eastern Barents Sea and the Kara Sea

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ABSTRACT

In this article, we present evidence for the migration of Cretaceous or younger oil into Paleozoic strata on the islands of Novaya Zemlya, Russian Arctic, originating from the surrounding basins of the Barents Sea and the Kara Sea. We thus suggest a novel petroleum system for the greater Barents Sea and Kara Sea regions.

Organic geochemical data reveal that medium mature petroleum is hosted in overmature Paleozoic rocks onshore Novaya Zemlya. This petroleum likely migrated from the surrounding offshore sedimentary basins of the Kara and Barents seas into the onshore strata on a broad front, covering 400 km (248 mi) along the archipelago. Thus, the findings describe the remnants of petroleum migration on a regional scale.

High maturities of the examined onshore strata (vitrinite reflectance [R_o] of 1.9–4.0% and conodont color alteration index values of 4–6) render the indigenous origin of the medium mature petroleum unlikely. Organic geochemical characteristics of the migrated hydrocarbons lead us to suggest the existence of a hitherto undescribed marine shale source rock with some contribution of terrigenous organic matter. The $\delta^{13}C$ isotope values varying within a range of 5‰ for bulk extracts as well as for individual n-alkanes and isoprenoids suggest isotopic heterogeneity of the organic source facies. The source rock units are inferred to have released hydrocarbons mostly at oil window maturities (higher than 0.6% R_o). The

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