

Ages and Depositional Environments of Barents Sea Petroleum

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Abstract

The SW Barents Sea is considered a multiple source rock overfilled basin. Changes in PVT conditions caused by uplift and burial may have resulted in re-distribution, mixing, and demigration of petroleum. Thus, determination of ages and organic facies on "blended-oils" may be complicated. Stable carbon isotopes, age specific compounds, and organic facies indicators were analyzed in a set of 50 oil and condensates to reach interference about their generative source rocks. Age determination based on $\delta^{13}\text{C}$ values, extended tricyclic terpane ratios and C28/C29 steranes suggested contribution from Late Carboniferous to Jurassic source rocks in the dataset. Furthermore, we found that characteristic tricyclic and tetracyclic terpane signatures are useful for differentiation of inferred Permian and Triassic from Jurassic derived oils. It was hence possible to define four petroleum groups: (1) Permian and Triassic oils, (2) Carboniferous oils, (3) Jurassic oil, and (4) Triassic and Jurassic condensates. This classification was in addition substantiated by multivariate statistical analysis.

Inferred organic facies variations suggest input of kerogen Type I, II/III, and III blends of organic matter. Parameters describing depositional environments e.g. Pr/n-C17 vs. Ph/n-C18, Pr/Ph vs. MDBT/MP and distribution of C27, C28, and C29 steranes indicate deposition in transitional environments. The cross-plot C25TT/C24TET vs. C26/C25TT suggests lacustrine deposition for inferred Permian and Triassic derived samples, and it is suggested that these compounds can be used to indicate basin-wide occurrence of the precursor compounds. Condensates, however, are characterized by contrasting marine and terrestrial signatures. These terrestrial facies signatures are concluded to be related to the preferential enrichment of lower boiling point compounds during fractionation.

Our findings indicate that Permian and Triassic petroleum today mainly occur on elevated basin margins or stable Platforms in the western part of the study area, while Jurassic signatures prevail in the Hammerfest Basin. It is concluded that reservoirs characterized today by Permian and Triassic oil signatures on the platforms or in tectonized regions have been "shielded" from additional Jurassic charges. Due to immature, early mature, or absent Jurassic source rocks, inferred Carboniferous, Permian, and Triassic sourced petroleum occur today mainly in the eastern regions.