«Petroleum Systems Conference 2023»

Palaeozic Petroleum System Wanted: Rather Alive than Dead

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The purpose of the lecture is to explore alternative origins to the oils in the Norwegian North Sea other than the prolific Upper Kimmeridge Clay equivalent source rocks (i.e., Draupne, Mandal and Tau formations).

When the first wells were drilled in the Norwegian North Sea, the Palaeozoic intervals were the main target due to their success in the southern North Sea. The oil discoveries were, however, encountered in shallower Upper Cretaceous chalk reservoirs and in rotated Jurassic fault blocks, mainly sourced by the Upper Jurassic Kimmeridge Clay equivalent source rocks. This resulted in less incentive to explore Palaeozoic plays. Nevertheless, 'peculiar' oils are reported in the Norwegian North Sea, suggesting contributions either from uncommon facies of the prolific Upper Jurassic source rocks or possibly from deeper buried, older source intervals.

The objective of this study is to improve the understanding of the Palaeozoic petroleum system in the Norwegian North Sea. In this study, 49 crude oils and seven oil-impregnated rocks from the Norwegian, Danish and British sectors of the North Sea have been geochemically analysed in an attempt to identify contributions from alternative source rocks. In addition, three source rock samples from the Zechstein Group in the Norwegian North Sea were analysed and compared with the oils.

The oils are mainly shown to originate from marine and terrigenous siliciclastic source rocks. However, the light fraction and sulphur content in some of the oils suggest contribution from a calcareous, highly mature source different from their respective heavy fractions, derived from a siliciclastic, low mature source. This suggests the calcareous contribution to either be derived from a deeper part of the Jurassic source rock kitchen with different facies or a deeper buried, Palaeozoic source rock. The sampled source rocks from the Zechstein Group are marine shales with elevated gammacerane concentrations on par with some of the analysed oils, thus, hinting at contributions from this interval. An unusual CSIA pattern observed in an area with a known presence of Palaeozoic-derived oil is also recognised in some other oils and is speculated to reflect a mix between Jurassic and Palaeozoic-derived oils.

Lesson learned: What would the lecturer want the audience to be left with and take with them from this speech:

There are strong circumstantial evidences for existence of a Palaeozoic petroleum system in the North Sea....both Dead and Alive.

Norwegian Petroleum Society