

The Arctic – A Tectonic Tour through the Last Great Petroleum Frontier

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Abstract

The Arctic Ocean occupies a unique tectonic setting as a small, confined ocean between two much larger oceans - the subducting Pacific margin and the opening North Atlantic. Unlike many of the world's oceans, evidence on both timing and geometry is poor, and major elements of the plate tectonic evolution are still "up for grabs". The Arctic has experienced significant plate motion from Cretaceous to present, and because of the ambiguities in the oceanic signature, resolving the most likely kinematic history is critical in understanding paleogeography and hence reservoir and source distribution. I will show a 3-stage kinematic model which, while not a unique solution, seems to best satisfy the known constraints.

As we take an animated tour through the Arctic's plate tectonic evolution, we will meet some of the major Arctic controversies. We will also see how radical changes in plate motion within this confined space led to juxtaposition in time and space of several significant transform margins. Such margins have distinct characteristics in terms of basin configuration, local structure and thermal evolution, knowledge of which are highly relevant to petroleum exploration in the Arctic.

The general consensus is that the Arctic contains a significant proportion of the world's undiscovered conventional resources, with gas probably predominating over oil. Thus, the region could contribute a major part of the world's energy mix in the next century. This thinking has provoked a marked surge in activity in recent years - marked by some landmark discoveries, but also by significant setbacks. The right geological setting and undiscovered resources only mark the beginning of the Arctic challenge. In this remote frontier, political, social, environmental, logistical and cost issues are equally important, and the ultimate fate of the Arctic petroleum resource remains open to debate.