

Petroleum potential of the southern and eastern margins of the Siberian Platform, Russia

AN EVALUATION OF PROVEN HYDROCARBON SYSTEMS AND DIRECTIONS FOR FUTURE EXPLORATION



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Executive Summary

With hydrocarbon resources in over-explored areas of Europe, the Middle East and North Africa becoming ever more depleted, the focus of hydrocarbon exploration is increasingly turning to frontier and remote areas in the Arctic and sub-Arctic regions, such as the vast territories of eastern Siberia. The Siberian Platform, an underexplored area in eastern Siberia stretching from the Yenisey River to the Verkhoyansk Mountains, is thought to host significant undiscovered reserves of oil and gas. The stratigraphic and palaeogeographic development of the Siberian Platform is reviewed from the Riphean-late Mesozoic and put into context with known petroleum systems encountered in key basins of the Platform. This review is supported by the addition of source rock distribution maps, chronostratigraphic and petroleum systems charts. It is envisaged that this timely work will contribute to the exploration and discovery of new hydrocarbon resources in this remote region.

Oil and gas accumulations in the Baykit and Nepa-Botuoba High provinces were sourced from middle-late Proterozoic (Riphean) source rocks, which were deposited in intracratonic depressions and clastic shelf settings. Migration of hydrocarbons occurred presumably in Early Palaeozoic times, when reservoirs and regional evaporitic top seals had already been formed. In the Nepa-Botuoba High province, hydrocarbons are likely to have migrated upslope (in a north-westerly direction in present co-ordinates) from fore-troughs in the Baikal-Patom Region into Vendian and Cambrian clastic and carbonate reservoirs, situated at the crest of large anticlinal structures. Restricted pods of organic-rich shales, e.g. the Iremeken unit in the Madra Graben, may source the giant hydrocarbon accumulations that are found in Riphean and Vendian clastic/ carbonate reservoirs of the Baykit High province. Structural and stratigraphic traps within shallow-marine sandstones of the Vanavara Formation, along with faulted Riphean stromatolitic limestones and vuggy dolomites which were karstified and leached during the late Riphean along the margins of large Precambrian uplifts, represent the most promising targets for future exploration along the southern margins of the Siberian Platform.

By contrast, in the Lena-Vilyuy Basin along the eastern margin of the Siberian Platform, petroleum exploration has been focused within the Permian-Jurassic post-rift clastic succession deposited along the passive margin of the Oymyakon Ocean, and only commercial gas accumulations have been discovered to date. Here, Late Permian coals and coaly shales have sourced large gas accumulations within Late Permian-Cretaceous continental-marine sandstones at the crests of broad anticlinal structures. These are largely concentrated on the Khapchagay and Loglor arches, along with frontal thrusts in the Cis-Verkhoyansk Foredeep, formed during inversion

of pre-existing rift structures during the Jurassic-Early Cretaceous. Pinch-out traps along the western margin of the basin are perhaps the most prospective for future exploration, along with the chance of finding oil, as migration pathways may exist for marine oil-prone Cambrian and Mesozoic (especially Early Jurassic) source rocks which sit within the oil window. The thick sequence of Late Devonian-Early Carboniferous syn-rift rocks, which were deposited in the centre of the restricted Ygyatta and Kempendiay rift basins, may also have the potential to host source rocks, reservoirs and cap rocks and could be considered as another potential target.

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