

Session: Russia, Former Soviet Union and the Circum-Arctic

Russia, FSU and the Circum-Arctic: 'the final frontier'

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Sixteen papers representing the petroleum geology of the Arctic, Russia and former Soviet Union were presented over the first day and a half of PGC VII. The region is huge, diverse and has generated a great deal of excitement and outside investment in the industry over the 20 years since the collapse of the Soviet Union. The Arctic region in particular has significance as perhaps the last great frontier hydrocarbon province on Earth. The region is large, approximately 5000 km across a polar view north of the Arctic Circle (Fig. 1). Importantly, from an oil and gas exploration perspective, the Arctic Ocean has the most extensive continental shelf area of any ocean basin (*c.* 50% of offshore area). Much of this sits in the broad Russian offshore Arctic in water depths of less than 50 m. There are numerous sedimentary basins in the Arctic, some well known, but most poorly understood. Art Grantz (United States Geological Survey) and colleagues estimated resources at 114×10^9 barrels of undiscovered oil and 2000×10^{12} standard cubic feet (SCF) of natural gas. If the estimates are correct, these hydrocarbons would account for more than a fifth of the world's undiscovered resources. This great prize, in a world of diminishing reserves, has recently brought territorial issues into focus between the five countries with claims in the Arctic Ocean (Russia, Norway, Denmark, Canada and the USA). All of this is taking place against a backdrop of increasing concern for the fragile Arctic environment.

Day one was dominated by the Arctic, the first half of which focused on the various models that are considered responsible for the tectonic origin of the Arctic and its basins. That such a wide variety of models is possible emphasized how much we still need to learn about the region. The discussions prompted by this session spilled over into lively debate in the poster session. The keynote by Al Fraser (BP) on the regional context of the Arctic Frontier Basins of Canada, Russia, Norway and the USA was given by John Berry and Edith Fugelli, who had stepped in to present at short notice. They described the Arctic as comprising two major deepwater basins floored by oceanic crust. These are the Eurasia Basin and the Amerasia Basin (Fig. 1). The Eurasia Basin as the extension of the North Atlantic rift system is relatively well constrained. However, the spreading history of the Amerasia Basin is less certain and is still the subject of some debate.

This was followed by Steve Bergman (Shell) who outlined the model for the development of the Arctic Ocean. Art Grantz (USGS) spoke about the recent work undertaken by the US Survey and collaborators to assess the petroleum potential of the region. Paul Green (Geotrack International) presented the results of numerous fission track studies that show synchronous widespread Cenozoic exhumation in the region and discussed its potential impact on hydrocarbon migration and trap integrity. Sergey Drachev (ExxonMobil) discussed the tectonic and petroleum geology of the Russian Arctic sector, outlining evidence for the various theories on the opening of the Arctic Ocean and the creation of the basins in this region.

Papers in the second half of the day discussed individual Arctic basins of the Russian and Norwegian Arctic sectors. Vladimir Verzhbitsky (TGS-NOPEC) showed the results of recently acquired seismic data in the North Chukchi Basin in the Russian Arctic, which have been used to construct an interpretation of the region's geological history and contain evidence for an active petroleum system. Jan Inge Faleide (University of Oslo) presented a paper on the sedimentary basins of the Barents Sea, comparing and contrasting the Western and Eastern basins. Jorg Ebbing (Geological Survey of Norway) described a joint project with the Russian VSEGEI institute on the palaeogeographic and tectonic evolution and present-day structure of the Barents and Kara Seas. Timothy Klett (USGS) expanded on the recent Arctic assessment by highlighting the potential of the Siberian shelf and craton, which has an estimated 28 MMBOE to be discovered.

Day two was the turn of Russia's petroleum geology to be examined and the keynote delivered by Steve Creaney (ExxonMobil) gave an overview of the numerous prospective basins in this vast country, using a genetic approach. The tectonic development of the region was used as a framework to address the diverse complexity of these different basins and their hydrocarbon systems. The tectonic evolution of the prolific West Siberian Basin from the Palaeozoic to the present was described by Mark Allen (Durham University), adding to the debate on the tectonic evolution of the Arctic started on the previous day. Robert Scott (CASP) presented an explanation of the curvature of the Novaya Zemlya fold-and-thrust belt and its offset from the remainder of the Uralian Orogen, based on recently collected field observations and regional tectonic synthesis. The significance of this interpretation for adjacent hydrocarbon basins was discussed. Erik Fjellanger (ExxonMobil) described 3D modelling of the hydrocarbon system of the northern West Siberian Basin, where he characterized the plays and source rocks and calibrated the model with some of the world's giant gas fields.

The neotectonics and effects of the Fennoscandian de-glaciation on Siberia were discussed by Mark Allen (Durham University). Finally the discussion moved to the Caspian, where two Kazakh field developments were explained. Firstly the exploration and appraisal of the technically and environmentally challenging, super giant Kashagan Field was presented by Didier Terroir (ENI), and lastly Simon Beavington-Penny (BG) presented work on integrating carbonate sedimentology and cross-well seismic to optimize the phased gas injection at Karachaganak.

The discussion continued into the poster sessions which, in a change from past conferences, allocated the authors a chance to present their posters. A steady number of 15–20 people contributed to these discussions with a free flow of debate amongst the audience and presenters. Robert Scott (CASP) continued the discussion on the opening of the Arctic Ocean by considering the



Fig. 1. Sedimentary basins of the Arctic. The Arctic region is large, approximately 5000 km across this polar view north of the Arctic Circle. There are two deepwater basins floored by oceanic crust and separated by the Lomonosov Ridge. These are the Eurasia Basin and the Amerasia Basin.

various models and their significance for how sediment was dispersed in the Arctic. New seismic from offshore Sakhalin was used to explore the petroleum potential of the Deriugin Basin by Alice Little (TGS-NOPEC), an area of recent developments by western companies. A collaboration to map the basins of the Arctic was presented by two of the joint authors (Sergey Drachev, ExxonMobil and Robert Scott, CASP). This map

categorizes the sedimentary accumulations of the Arctic according to their tectonic affinity. Henrik Stendal (Bureau of Minerals and Petroleum) presented his poster on the hydrocarbon potential of the East Greenland Margin. Finally, the prospectivity of the eastern Black Sea was discussed by Li Guo (CASP), who presented work on the analogue late Jurassic reefs of the western Caucasus and Crimea.