SEAPEX Exploration Conference 2005
Orchard Hotel, Singapore
5th – 7th April 2005

ABSTRACT

Author(s) : Matthew Brettle, Ian Glenister, Richard Barrett, Stephen Collins, Graham Tiley & Susanne Witte
Company Affiliation : Shell International E&P

The Interaction of Tectonics and the Sedimentary Record; The Miocene of the Sakhalin Shelf

Sakhalin Island is a prolific petroleum province on the western fringe of the Sea of Okhotsk - and area that has experienced active tectonics since the Early Miocene. Since the discovery of the Odoptu field in 1977 the emphasis of petroleum exploration in the Sakhalin region has shifted from onshore to offshore. We present an overview of the current regional stratigraphic and tectonic evolution on the offshore area around the petroleum fields of Piltun, Astokh and Lunskoye. These fields lie in a zone that has experienced two relatively recent tectonic events; the propagation of a N-S trending shear zone in the Miocene and regional inversion during the Pliocene. Both tectonic events affect the success or failure of the reservoir and structure in these petroleum systems.

During the Miocene, northern Sakhalin was uplifted, due to the northward propagation of a right-stepping strike-slip fault system that gradually cut off sediment supply to the east Sakhalin shelf from the paleo-Amur delta. The cut-off of the Amur River led to the formation of a broad (100km wide) shelf along the eastern seaboard of Sakhalin. At the same time, erosion and denudation of the island produced a local, but mature sediment source that supplied the East Sakahlin Shelf. Simple cut and fill channels (1-2km across, max. 40m deep) are interpreted as easterly trending draining channels that drained off the island during this period. Integration of core, well log and 3D seismic data from these fields reveals subtle synthetic and antithetic strike-slip faults that influenced both the positioning of the simple channel systems and the stratigraphic stacking patterns on the shelf.

NE-SW directed transpression during the Pliocene led to growth of large NNW-SSE trending fold structures on the East Sakhalin shelf, which formed the structural closures of the Piltun, Ashtokh and Lunskoye fields. To the north of Piltun and Astokh, large-scale canyon systems (100+m deep, 5km across) are located in areas where the greatest amount of Pliocene uplift occurred.
We reveal that the principle critical success factors effecting the East Sakhalin shelf petroleum system are i) the timing of shear zone propagation, island uplift and its effect in switching sediment supply from an Amur River to a locally reworked source, ii) the fortuitous late stage Pliocene inversion, which generated large, open anticlines with extensive petroleum drainage areas, and iii) the expulsion of hydrocarbon from

regionally extensive Machigar source rocks from the Pliocene to present day. In summary, Sakhalin presents an excellent example of the delicate balance that exists between the need for quality reservoir and sealing units and good source rocks within the hydrocarbon expulsion window. In addition, the presence of two relatively recent tectonic events has proven beneficial, if indeed the critical factor in controlling the success of these fields.