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Interaction of sediment supply, sea level, ocean circulation and tectonics on Cenozoic sedimentation on Sakhalin, Russian Far East.

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Understanding the geological evolution of Sakhalin and the Sea of Okhotsk as a whole is the key to unravelling the hydrocarbon potential of the region. Sedimentological and tectonic studies of Sakhalin provide detailed information on the relative importance of sediment supply, tectonic activity, eustasy, ocean circulation and palaeoclimate and their controls on the generation of hydrocarbon systems. Limited biostratigraphic constraints make regional correlation difficult.

The Cenozoic sedimentary history of Sakhalin starts in the Eocene with the deposition of dominantly westerly-derived fluvial sediments, rich in locally derived, lithic arenite sands with clasts from an accretionary complex and magmatic arc, probably sourced from the Sikhote Al'in mountain range to the west.

Subsequently during the Late Oligocene, transgressive marine mudstones were deposited over Sakhalin. The presence of dropstones and pseudomorphs of ikaite indicate the presence of seasonal sea-ice and cold climatic conditions. This relative sea level rise and the cold climate may have led to limited erosion of western source areas, reducing the amount of locally derived sediment supply. Active strike slip faulting is recorded all over Sakhalin.

The Early Miocene saw the return of fluvio-deltaic sediments, prograding over central western Sakhalin. Locally derived coarse-grained lithic arenites were deposited as well as arkosic sands. The arkosic sands are postulated to show evidence of a far sourced provenance, possibly a palaeo-Amur signature. In-situ coal deposits provide evidence for plant colonisation and prolonged subaerial exposure of the delta system and deposition in a warm, wet climate. New back-arc basins of the Kuril arc and of Japan are thought to have formed to the south of Sakhalin at this time.

Middle Miocene deposition in central Sakhalin is believed to be dominated by palaeo-Amur derived, well-sorted subarkosic sandstones. These are tidally-influenced shallow shelf deposits, affected by palaeocurrents flowing towards the southwest, considered to result from reworking by longshore currents related to anticlockwise circulation in the Sea of Okhotsk. A series of ~10 cleaning-upward, hundred metre thick units, reflect the overall aggradation of the shelf. Approximately 800-1000 m of sand were deposited onto the shelf at this time recording a high sediment supply rate of approximately 500m/Myr, during a relative sea level rise.

During the Late Miocene, relative sea-level continued to rise gradually, resulting in the deposition of muds and silty muds on Sakhalin with restricted sediment supply from the palaeo-Amur River, probably resulting from sediment trapping further upstream.

The Pliocene saw the reinstatement of proximal palaeo-Amur deltaic facies. Sandstones were deposited in fluvially dominated systems with palaeocurrents distributing sediment to the east and north onto northern Sakhalin. New emergent structural barriers grew longitudinally on both sides of Sakhalin and the Schmidt Peninsula. Climatic conditions became cooler again at that time as indicated by dropstones and ikaite pseudomorphs encountered within the sediments.

The controlling parameters on sediment distribution onto the shelf and into the Sea of Okhotsk through the Cenozoic have a bearing on the prediction of reservoir locations. This ongoing work forms part of our palinspastic and palaeogeographic reconstructions for the Sea of Okhotsk.