The Khuray deep-water fan: a beautifully complex lacustrine depositional system of Lake Baikal

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Lake Baikal (Russia) is the World's oldest and deepest lake, which has been formed within a recently active rift zone at the edge of Siberian platform. Active tectonics influences all subaqueous geological processes in the Lake area with sedimentation, in particular. Selenga River is the largest river flowing into Lake Baikal. The river carries a large amount of terrigenous material sourced from Siberian-Mongolian drainage basin. Selenga River forms a large delta and several deep-water fans in the Central and South Baikal basins. Large amount of supplied terrigenous material, high sedimentation rates, steep slopes of the Baikal basins and active tectonic are favorable factors for the development of gravity-driven sediment transport processes.

A new large depositional system, named the Khuray deep-water fan, was discovered and studied since 2014 in the deep part of Lake Baikal during six Class@Baikal Project expeditions. It is located at the south-west of the Central basin of Lake Baikal, where it occupies a narrow, SW-NE extended area of about 1500 square km. Several 2D seismic surveys and bottom sampling campaigns were run during the expeditions in this area ranging in water depth from 800 to 1580 meters. A comprehensive set of collected geophysical and geological data provided important insights on the architecture of the Khuray lacustrine deep-water depositional system.

The system is fed by the Kukuy canyon, which is incised into the north part of the Selenga delta-front. In its upper reaches, immediately beyond the mouth of the Kukuy canyon, the Khuray system is represented by a set of meandering channels forming typical deep-water channel-levee complexes, which are well-expressed in bottom topography. The central part of the system develops over a large uplifted fault block, which is separated from the rest of the Central basin by a well-expressed tectonic escarpment up to 80 m high. Within the block the system of the meandering channels is gradually replaced by a system of less distinct channels, which form a large braided channel complex less commonly observed in deep-water fan systems. At the distal part of the system, the channels become better expressed in bottom relief again and begin merging with each other forming, eventually, a single main channel. Another very interesting feature, a secondary canyon, is also observed at the distal part of the Khuray system. Once the small channels converge into the single one, it reaches a tectonic escarpment and forms a distinct
erosional incision named the Khuray canyon. Several depositional lobes forming the lower reaches of the Khuray fan are found beyond the mouth of this secondary canyon, which is associated with a base of an active tectonic fault.

Active tectonic processes are believed to be the key factors responsible for the development of such complex architecture of the Khuray lacustrine deep-water depositional system comprising typical slope meandering channels, braided channel complex and several cascading canyons.

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