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The enigmatic diapir-like structures in the Elovsky area (Lake Baikal): main characteristics and formation hypothesis

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Lake Baikal is the largest fresh water lake on Earth and has been target of numerous expeditions to investigate the mechanisms of diffused fluid migration that characterize large part of this basin. Among the numerous areas that have been investigated during the Training Through Research Class@Baikal program, here we report the findings from the Elovsky area located in in the northern part of the southern basin of the lake. Initial surveys in the area conducted geophysical investigations that revealed the presence of acoustic anomalies and enigmatic positive structures scattered on the lake floor. These are characterized by low-amplitude parabolic reflection over the bottom and sub-circular landforms with width of 200-300 meters and height of 10 to 25 meters. Seismic data also detected a buried lenticular semi-transparent sedimentary body (thickness of 30-90 meters) spread over most of the study area at a depth of 20-60 meters in average. This unit can be clearly distinguished from the parallel-layered seismic record of the host sediments, and is interpreted as a large landslide or a vast high-density gravity flow deposit. The structures described above are spatially confined to the area of spreading of the lenticular body, in connection with which we can assume their genetic relationship.

Bottom sampling targeted the topmost part of these positive structures and recovered layers of clayey silt and silty clayey silt and in some instances were retried very dense and compacted dry silt-clay, which is an unusual texture for the bottom sediments of Baikal. Gas extracted from these sediments revealed higher concentrations of methane, in particular at the topmost localities.

Based on the collected data we propose that the genesis of the Elovsky features is associated to clay diapir-like mechanism, somehow similar to that observed at mud volcanoes. The roots of this system reach the transparent landslide deposits. We argue that these deposits are likely gas saturated and triggered the slow extrusion of these compacted sediments.