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What is controlling shallow active methane seeps in Lake Baikal? Posolsky Bank case-study

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Active methane seeps and gas hydrates occur worldwide in the marine environment especially at continental margins. Lake Baikal represents a unique case to study active methane seeps and gas hydrates in an active tectonic, lacustrine setting. In this study we present and explain the distribution of several shallow active methane seeps located on the Posolsky Bank, a major tilted fault block in the central part of Lake Baikal.

Active methane seeps were detected with a single-beam echosounder, which is able to detect gas bubbles in the water column due to the impedance contrast between water and free gas (bubbles). Possible fluid-flow pathways below the lake floor have been mapped based on the integration of the seep positions and high-resolution sparker seismic data. Subsurface sediment characteristics of a possible fluid pathway have been derived from BDP-99 well data.

The detected seeps occur near the crest of the Posolsky Bank above the Posolsky fault system. Seismic data suggest, however, that the fault does not act as a fluid conduit resulting in seepage, but rather cuts off a gas-bearing layer. This possible gas-bearing layer could be traced, down the Posolsky Bank, to within the theoretical gas-hydrate stability zone, where it shows up as a series of enhanced reflections on the seismic data. Enhanced reflections on seismic data are possible indications for the presence of free gas in the subsurface. The enhanced reflections are positioned below the theoretical base of the hydrate-stability zone. Sediment characteristics of the gas-bearing

layer, derived from the BDP-99 well data (Bezrukova et al., 2005), suggest a sandy layer covered by clayey sediments.

Our data suggest that the shallow gas seeps near the crest of the Posolsky Bank are partially supplied by methane from below the base of the gas-hydrate stability zone. This differs from other deep-water Baikal seeps and mud volcanoes, which are believed to be related to destabilizing gas hydrates under the influence of a tectonically controlled geothermal fluid pulse along adjacent faults (De Batist et al., 2002).

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