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Distribution of lacustrine gas seeps and mud volcanoes in Lake Baikal, Siberia

L. Naudts (1), M. De Batist (1), N. Granin (2), O. Khlystov (2), P. Van Rensbergen (1), J. Poort (1), W. Criel (1), J. Klerkx (3) & the SONIC Team (4)

(1) Renard Centre of Marine Geology (RCMG), Gent University, Krijgslaan 281 s8, B-9000 Gent, Belgium (Lieven.Naudts@UGent.be), (2) Limnological Institute SB RAS, 664033 Irkutsk, Russia, (3) International Bureau of Environmental Studies (IBES), Rue Audrey Hepburn, 9/13, B-1090 BRUSSELS, Belgium, (4) SONIC, Angliisky Avenue, 190121, St. Petersburg, Russia.

Gas seepage and mud volcanism in a lacustrine environment was first discovered on the deep basin floors of Lake Baikal in 1999. Later on gas seeps were also detected in shallow parts of the lake on echosounder recordings or by visualization of gas bubbles at the lake surface. In this presentation we want to give an overview of the distribution of gas seepage and mud volcanism in relation to the geologic settings of the different seep areas.

From the integration of the available data sets (echosounder bathymetric data, echosounder water-column data, side-scan sonar imagery and seismic subsurface data) we can observe different seeps locations, each within a different geological environment:

1. shallow seeps located in deltaic environments (e.g. Babyshkin)
2. shallow seeps located at fault scarps (e.g. Posolsky Bank)
3. deep seeps located above mud volcanoes
4. deep seeps located near canyons (Kukuyu Canyon)

The shallow seeps are commonly very active. Within the deltaic environments, the methane is most likely formed by the decomposition of organic matter in the shallow

subsurface. Nevertheless deeper sources of methane cannot be excluded in the highly active tectonic setting of Lake Baikal. Other shallow seeps are located on a fault scarp, near Posolsky Bank. Seismic data suggest, however, that the fault does not act as a conduit for seepage itself, but rather cuts off a gas-bearing layer.

For the deep seeps above the mud volcanoes, active faults and the presence of gas hydrates seem to be primordial. The venting sites are attributed to hydrate destabilization at the base of the GHSZ under the influence of a geothermal fluid pulse along nearby faults. Methane release is not continuous (probably tectonically controlled; most mud volcanoes are not active at present) and the source of methane is destabilizing gas hydrates at 200-300 m sub-bottom depth.

Seepage in Kukuyu Canyon is linked to mud volcanoes and gas-hydrate destabilization in the deeper part. In the more shallow part seeps seem to originate from organic-rich sediments supplied by density currents sourced by the Selenga River.