ACTIVE DESTABILISATION OF GAS HYDRATE ACCUMULATIONS IN LAKE BAIKAL BY TECTONICALLY INDUCED FLUID-FLOW

M. De Batist (1), J. Klerkx (2), M. Vanneste (1), J. Poort (1), P. Van Rensbergen (1), A. Golmshtok (3), A. Kremlev (4), O. Khlystov (5)
(1) Renard Centre of Marine Geology, Ghent University, Belgium, (2) Royal Museum for Central Africa, Tervuren, Belgium, (3) Institute of Oceanology, St.Petersburg, Russia, (4) Computer Centre, Novosibirsk, Russia, (5) Limnological Institute, Irkutsk, Russia
marc.debatist@rug.ac.be/Fax: +32-9-2644967

Multi-channel seismic profiling and deep drilling have evidenced the presence of gas hydrates in Lake Baikal, Siberia. They occur in the deep basins around the large Selenga River Delta. The presence of the hydrates is evident on seismic records by virtue of a distinct high-amplitude, reversed-polarity, cross-cutting BSR. Locally, however, the BSR shows a very anomalous behaviour. In the vicinity of some of the main, active, intra-basin faults, its depth strongly fluctuates, with undulations (positive as well as negative compared to background positions) and vertical displacements of several hundreds of ms TWT. Locally, the BSR is even entirely disrupted by vertical 'chimneys' that reach up to the lake bottom.
High-resolution deep-tow side-scan sonar mosaics over one of such areas of deformed and disrupted BSR show a cluster of morphological irregularities on the lake floor, in contrast to areas above a regular BSR where the lake floor is absolutely regular and flat. Four large irregularities - aligned parallel to the fault - were discovered, one of them coinciding with one of the 'chimneys'. They were mapped in detail by bathymetric sounding and proved to be either elevations (mud volcanoes ?) or depressions (craters) at the lake floor. Echosounding has also shown venting associated with these features, which is evidenced by an acoustically non-transparent plume, reaching 10-25 m above the bottom (in other places in a similar context plumes were observed of > 200 m of height). CTD-profiling, which shows very little change in bottom-water temperature at the venting sites, suggests that the plumes represent cold seeps.
Heat-flow values measured over the area show a good correlation with changes in BSR depth: values vary between 50-60 mW/m² to 80-90 mW/m². In the craters, heat-flow values are highest, but they do not exceed 165 mW/m².
Our observations suggest that the Baikal hydrates are locally - along particular segments (about 15 km long) of active faults - destabilizing by tectonically controlled upward flow of fluid and heat, and that this results in active venting of gasses and/or fluids at the lake floor.