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MUD VOLCANISM AND GAS SEEPS IN LAKE BAIKAL: CAUSES AND CONSEQUENCES

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After the discovery in 1999 of a series of mud volcanoes on the deep basin floors of Lake Baikal and of the presence of an anomalous thermally-mixed water layer attributed to methane venting, the lake floor was investigated in more detail in order to identify all possible sources of methane and to understand the processes leading to mud volcanism and methane release at the Baikal lake floor. New data show the presence of at least 4 mud volcano provinces, each consisting of several individual mud volcano structures, and of several areas of gas venting. All mud volcanoes occur in water depths of $>$ 1000 m, within the GHSZ and in areas of abnormally shallow BSR, and are closely associated to large, active faults. They are attributed to hydrate destabilisation at the base of the GHSZ under the influence of a geothermal fluid pulse along the nearby fault. Methane release is not continuous (probably tectonically controlled; most mud volcanous are not active at present) and the source of methane is destabilising gas hydrates at 200-300 m subbottom depth. In addition, a whole series of methane vents (i.e. without distinct morphological expression) occur in shallower-water areas. These venting sites occur mostly in deltaic environments, but some are also associated with faults, and are always outside the GHSZ. Methane release appears to be more continuous (many are now active) and the source of the methane is probably shallow subsurface methane formed by the decomposition of organic matter, although deeper sources can not be excluded.
Consequences of methane venting for the waters of Lake Baikal are the presence of a thermally-mixed water layer, wich could (if persisting and increasing in thickness) lead to a permanent stratification of the water column. This could influence the

water mixing process and have major influences on the oxygenation of the lake and the benthic biota. In addition, increasing evidence is becoming available that some of these seeps may influence the water column (directly, or via associated temperature-driven circulation effects) up to the surface, causing localised melting or non-freezing of the winter-ice cover and even massive fish deaths. Measurements of surface-water and near-surface air methane concentrations are currently underway.
The influence of the methane seeps (up to a few years not even suspected in the largest lake on Earth) on the entire lake system may thus be extremely important.