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Methane release by freshwater pockmarks

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In the eastern part of Lake Constance (Germany) near the Rhine River hundreds of pockmarks, morphological depressions at the lake floor, were observed. The diameter of these pockmarks was up to 16 m and at a high number of them permanent release of methane bubbles was detected. The isotopic analysis of the escaping gas indicated methane of biogenic origin.. At the shallow pockmarks (10 m), migration of gas bubbles through the sediment caused increased methane concentrations in the pore waters close to the sediments as compared to sites unaffected by bubble migration outside the pockmarks. Thus, the diffusive methane flux and oxidation rates were much higher inside the pockmark than outside. Nevertheless, methane ebullition into the water column is by far the dominating pathway of methane release (estimated 10 L h-1). At the deep pockmark (80 m) – even though bubble release was observed -, the sediment inside the pockmark had the same methane concentrations and geochemistry compared with a reference site outside the pockmark. In profundal freshwater sediments a strong recent methanogenesis leads to high methane concentrations, often above saturation. So, additional emerging methane (bubbles) from deeper layers escapes from the sediment essentially unaffected by diffsuion into the sediment or by methane oxidation. Thus, the background concentration of methane in the sediment, determines if methane passes through the sedimentary filter or is directly released into the water column and possibly the atmosphere.