

## EBULLITIVE FLUX OF EARLY-DIAGENETIC METHANE FROM RECENT FRESHWATER SEDIMENTS: PRELIMINARY MASS FLUX AND ISOTOPIC BUDGET OF A GREENHOUSE GAS

M. O. JĘDRYSEK

*Laboratory of Isotope Geology and Biogeochemistry, University of Wrocław, Cybulskiego 30, 50-205 Wrocław, Poland*

Observations of methane ebullition from freshwater lake sediments at depths of 2.8 m and 4.2 m, and occasionally depths of 4.5, 5.5 and 11 m, were carried out. The closed, artificial lake Nowa Cerekiew (SW Poland), about 30 years old, with 25 cm thick organic-rich sediments, was selected for this study. Collection of gases was carried out using bottom-situated funnel-shape collectors with connected flasks (exchanged by scuba diving). The observations were under way between 1992 and 1996, including winters when the lake was covered by ice. Concentration of methane in ebullition varied from 9.06 % (winter) to 76.82 % (early summer). Ebullition (expressed as the mean diurnal production of carbon trapped into the collectors in the form of bubbles of methane naturally released from 1 m<sup>3</sup> of the most productive 25 cm uppermost layer of the sediments ((C-CH<sub>4</sub>)×day<sup>-1</sup>×m<sup>-3</sup>)) varied from about 100 mg (C-CH<sub>4</sub>)×day<sup>-1</sup>×m<sup>-3</sup> to near zero during winter (Fig. 1). In contrast to the deeper sampling station (4.2 m), the ebullitive methane from the shallower depth (2.8 m) showed substantial seasonal variation in the δ<sup>13</sup>C(CH<sub>4</sub>) value, from -63.12 ‰ during winter to -52.46 ‰ during summer. The global freshwater lake ebullitive CH<sub>4</sub> flux was estimated at about 5×10<sup>8</sup> g (C-CH<sub>4</sub>)×y<sup>-1</sup>.

The observed enhanced ebullitive CH<sub>4</sub> flux during summer (Fig. 1) and the higher δ<sup>13</sup>C(CH<sub>4</sub>) value (Fig. 2) during early summer are apparently a result of: (i) efficient decomposition of the fresh organic matter, deposited into the anoxic zone on the sediment surface, and consequently a relatively enhanced acetic acid pathway and, (ii) increased bacterial activity at the higher temperature. The lower δ<sup>13</sup>C(CH<sub>4</sub>) value in the deeper sampling station during summer may be a result of: (i) longer time for the organic matter to sink to the greater depth resulting in greater decomposition of easily degradable compounds which are the main precursors of acetate, (ii) perhaps an increase of bioavailable DIC, due to elevated pressures and lower temperatures at the greater depths, enhancing the CO<sub>2</sub> pathway, and (iii) limited diffusion of isotopically depleted carbon-bearing compounds from greater depths.

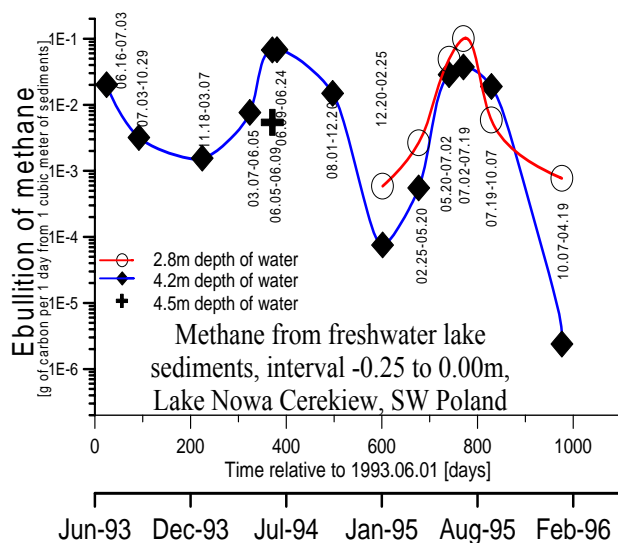


Fig. 1.

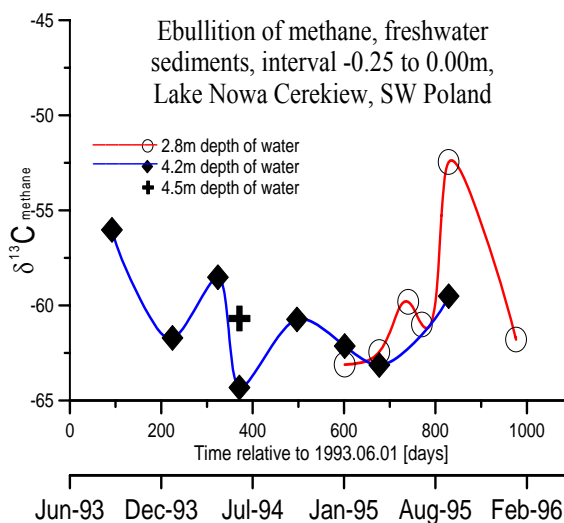


Fig. 2.