Supporting information, L78

From $M_B$, the volume of the bubbles ($V_B$) and their equivalent spherical diameter ($d_B$) at atmospheric pressure were determined, assuming that the CH$_4$ content in the bubbles ($%_{CH4}$) is known, according to Eq. (S5) and (S6), respectively.

\[
V_B = \frac{M_B}{16} \cdot \frac{R \cdot T}{P} \cdot \frac{1}{%_{CH4}} \quad \text{(S5)}
\]

\[
d_B = 2 \cdot \sqrt[3]{\frac{3V_B}{4\pi}} \quad \text{(S6)}
\]

where 16 is the molecular weight of CH$_4$ (g), $R$ is the universal gas constant (L atm mol$^{-1}$ K$^{-1}$), $T$ is the temperature (K) and $P$ is the atmospheric pressure (atm).

Since bubble volume and diameters are important for mass transfer determination during their migration to the lake surface, the actual bubble volume ($V'_B$) at a given depth ($D$) within the water column is given by Eq. (S7).

\[
V'_B = V_B \cdot \frac{P}{\left(\rho \cdot g \cdot D\right)^{\frac{1}{101,325}} + P} \quad \text{(S7)}
\]

where $\rho$ is the water volumetric mass density (kg m$^{-3}$), $g$ is the standard gravity (m s$^{-2}$), and 101,325 is the conversion factor from Pa to atm.