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CO2 and O2/N2 variations in and just below the bubble-clathrate transition zone of polar ice cores

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CO2 measurements on the EPICA DML ice core in depth levels just below the bubble ice – clathrate ice transition zone (> 1230 m) reveal variations of up to 25 ppmv within centimeters corresponding to a few years. Similarly unrealistic results are found at this depth region of the Dome C and the Talos Dome ice cores. Since all known processes altering the concentration of CO2 in ice cores can be excluded, we hypothesise that the enclosed air is strongly influenced by diffusion processes during the transition from bubbles to clathrates. The caused alteration of the gas composition extends over several hundred meters in the ice core (until approx. 1600m) before the initial atmospheric information is recovered.

Based on all CO2 results available from the three climatologically different drilling sites, we present a detailed hypothesis about how the enclosed gas composition is changed during clathrate formation. The hypothesis is supported by a 1D diffusion model and will be tested by O2/N2 measurements at exactly the same depth where strong CO2 variations are detected.