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Carbon geochemistry of plankton-dominated samples in the Laptev and East Siberian shelves: contrasts in suspended particle composition

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WEGAS measurements of CO2aq

Cavity ring-down spectrometer (CRDS) measurements were used to continuously monitor CO2 concentrations and δ13CCO2 composition of gas stripped via headspace equilibration from the water column using the Water Equilibration Gas Analyser System (WEGAS) (Thornton et al. 2016). It consists of three major components:

a) Water handling system including i) showerhead equilibrator (head space volume 1 L) fed by the sea water intake described above, ii) continuous pH measurements by E&H electrode probe and iii) T and salinity measurements by Seabird TSG 45.

b) CRDS gas analyzers for CO2 stable carbon isotopes (model G2131-i, Picarro Inc., Sunnyvale, CA) and CO2 concentrations (model G2301, Picarro Inc., Sunnyvale, CA).

c) Gas handling system with circulation pumps for headspace and ambient air from meteorological tower.

Continuous measurements of surface water CO2 and $\delta^{13}C\text{-}CO_2$, were thus performed using IB/Oden's seawater intake. Water was pumped through spray nozzles into the open headspace equilibrator at ~4.5 L min-1. By creating a fine spray of droplets, the exchange surface between headspace and water is maximized and an optimal equilibration is achieved. The gas of the headspace was analysed using two different CRDS (cavity ring-down) analysers. The second analyser was operated in parallel and its flow (~25 mL min-1) was not fed back into the closed cycle. Thus, it created a defined vent flow. This vent flow is compensated by a flow of ambient air (AA) taken from the top inlet of the meteorological tower (20 m height). To be able to correct the data for the vent flow, the concentration of CO_2 and $\delta13C\text{-}CO_2$ in AA is monitored by frequent switching. During the SWERUS-C3 expedition, continuous CO2 and $\delta13C\text{-}CO_2$ measurements in the surface waters have been performed in the period 10 July - 9 August resulting in a total of 238 864 data points. Instrumental accuracy was <1ppm for CO_2 and <0.1‰ for $\delta^{13}C\text{-}CO_2$.

For this study, all measurement data taken within a time window of +/-5min around the specific start times of the sampling were averaged to account for filling time of the canister and residence time of the water in the sea water intake.