# Modeling of the role of organic matter in the carbonate system seasonal changes in the Barents Sea

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This work aimed in studying of the role of seasonality of the biogeochemical processes of organic matter production and decay in the seasonal changes of the carbonate system (pH, pCO2, aragonite saturation). Data received at a transect Tromsø – Spitsbergen with a Ferrybox equipped SOOP vessel was used for verification. A 2D simplified vertical model was used to parameterize the hydrophysical processes of at a Coast-Open Arctic section. The biogeochemical processes were parameterized using OxyDep, simplified biogeochemical model aiming time scales seasonal and larger, that considered inorganic nutrient (NUT), dissolved (DOM) and particular (POM) organic matter and biota (BIO). Dissolved inorganic carbon (DIC) and alkalinity (Alk) were considered as independent model parameters. DIC changes were correlated with NUT using Redfield ratio, Alk was changed in the marine boundary of the modeled transect. The carbonate system equilibration was considered as a fast process and calculated at every time step using an iteration procedure. The carbonate system modeling was described on the base of standard approach. According to the model estimates the summer formation of DOC and POC and their further destruction can play a compatible role in the carbonate system seasonal dynamics. Modeled seasonal variations of pH (~0.2) are close to the observed ones t, i.e. 7.94-7.99 in February and 8.04-8.16 in August (pH(Tot)).The received results allowed to demonstrate that the upper layer water pCO2 varies from 480 ppm in winter to minimum values of 280 ppm during the OM production period. Therefore summer invasion of CO2 should be replaced by winter evasion.

# Decompression melting in tectonics: Where's the melt?

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The presence of melt in the continental crust influences tectonics. Using petrogenetic grids and pseudosections for fertile bulk compositions, multiple authors have invoked decompression across hydrate-breakdown melting reactions as an important factor enhancing exhumation and the development of gneiss domes, and in the production of late orogenic granites. However, the amount of melt that can be produced during decompression is strongly dependent on the fertility of the crust at the $T$ of interest and the melt generated may be quite small if, as expected, melt is lost each time the melt fraction reaches the melt connectivity transition (MCT) at 7 mol% (~7 vol%). Thermodynamic modeling of an average amphibolite facies metapelite was undertaken in the NCKFMASHTO system using THERMOCALC and the Holland & Powell dataset to investigate decompression across the major melt-producing reactions following prograde heating and episodic melt loss. The modeling places constraints on the quantity of melt that can be produced from progressively more residual rocks during decompression. $P$–$T$ pseudosections were calculated for isobaric heating at 1.2 GPa followed by decompression to 0.4 GPa at 750°C, 820°C, and 890°C. Melt was periodically removed from the system at the $P$–$T$ conditions where the melt fraction reached the MCT (85 % of the available melt is extracted); a new bulk composition was obtained and a new $P$–$T$ pseudosection was calculated. For isothermal decompression at 750°C, the protolith produces ~20 mol% total melt; ~8 mol% melt is produced prior to crossing the field where melting associated with Ms + Qtz breakdown is initiated and Kfs starts to grow, and an additional ~6 mol% is produced at $P$ <0.5 GPa. For isothermal decompression at 820°C, the residual composition produces ~3 mol% melt to 0.6 GPa and another ~13 mol% melt within the Crd stability field to 0.4 GPa. At 890°C, isothermal decompression occurs at ~5°C above the elevated solidus in the most residual composition, which produces ~3 mol% melt. These results demonstrate that integrating melt loss into model $P$–$T$ paths involving prograde heating and suprasolidus decompression yields lower quantities of melt during the decompression segment than commonly invoked. Based on these results, tectonic and petrogenetic models that require decompression melting may need re-evaluation.