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Organic matter respiration meets silicate weathering: Diagenetic processes in fjord sediments of Southern Iceland

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The chemical weathering of mafic magmatic rocks (e.g., basalt) is known to remove CO_2 from the atmosphere, transforming it into dissolved or solid inorganic carbon phases. Whilst the thermodynamics and kinetics of such weathering reactions are reasonably well-understood in controlled experimental systems, natural marine sediments contain a wide variety of organic and inorganic phases as well as microbial communities. These all have significant impacts on the "submarine weathering engine", e.g., increasing weathering potential by lowering ambient pH, or decreasing the CO_2 removal potential by forming authigenic clay minerals. Environments rich in reactive organic matter, mafic silicate minerals, and amorphous silica (e.g., ash, biogenic opal) reflect this natural complexity, and can serve as natural laboratories for understanding what controls submarine silicate weathering. Such conditions can be found in near-shore environments with relatively high primary productivity and a mafic hinterland, for example around the volcanic island of Iceland. Here we will present geochemical sediment and pore water data down to ~5 m sediment depth from Hvalfjördur (SW Iceland, ~60 m water depth) and Reydarfjördur (SE Iceland, ~70 m water depth) taken during the 2023 DEHEAT research cruise onboard RV *Belgica*. Our data show intense diagenesis that is related, on the one hand, to organic matter degradation and, on the other hand, to submarine silicate weathering. In brief, the sedimentary material is fine-grained with a relatively uniform composition, and is particularly rich in iron, titanium and magnesium compared to average shale. Tentative sedimentation rates are on the order of 0.5-1 cm/year, and organic carbon ranges between ~1 and 3 wt%, with a dominantly marine origin based on TOC/TN ratios. Ikaite crystals are found at various depths through the sediments. Sulphate-methane transition zones are established at ~1 m sediment depth, but pore water alkalinity and DIC linearly increase to, and probably beyond, the deepest sample. Dissolved silica is very high and its profile shows (together with lithium) undulating downcore structures hinting at silicate dissolution, but also clay mineral formation. Isotopic analyses and reaction-transport modelling are pending and will hopefully provide more detailed insights into the coupled and/or competing dissolution/precipitation processes occurring in these sediments.