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Glacial silicate dynamics in Arctic fjord and riverine sediments

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Objective and methods

Objective: Determine if glacial river or fjord sediments are net sinks or sources of dissolved silicon (dSi) to the coastal environment.

Methods

- Radioactive ³²Si was used in 4-6 day time-series incubation experiments using glacial river and fjord sediments from Ny-Ålesund, Svalbard.
- Sample locations (Fig 1) included three fjord (KB2, KB5, KB8) and three glacial river (GL1, GL2, GL3) sites.
- Biotic and abiotic processes were evaluated through live and dead treatments, the latter using a biocide.
- Blank/control tubes did not contain any sediment
- At every time point, each sample was processed as shown in the experimental flow chart (Fig 2) to determine silica concentrations in each phase in the particles and in solution.

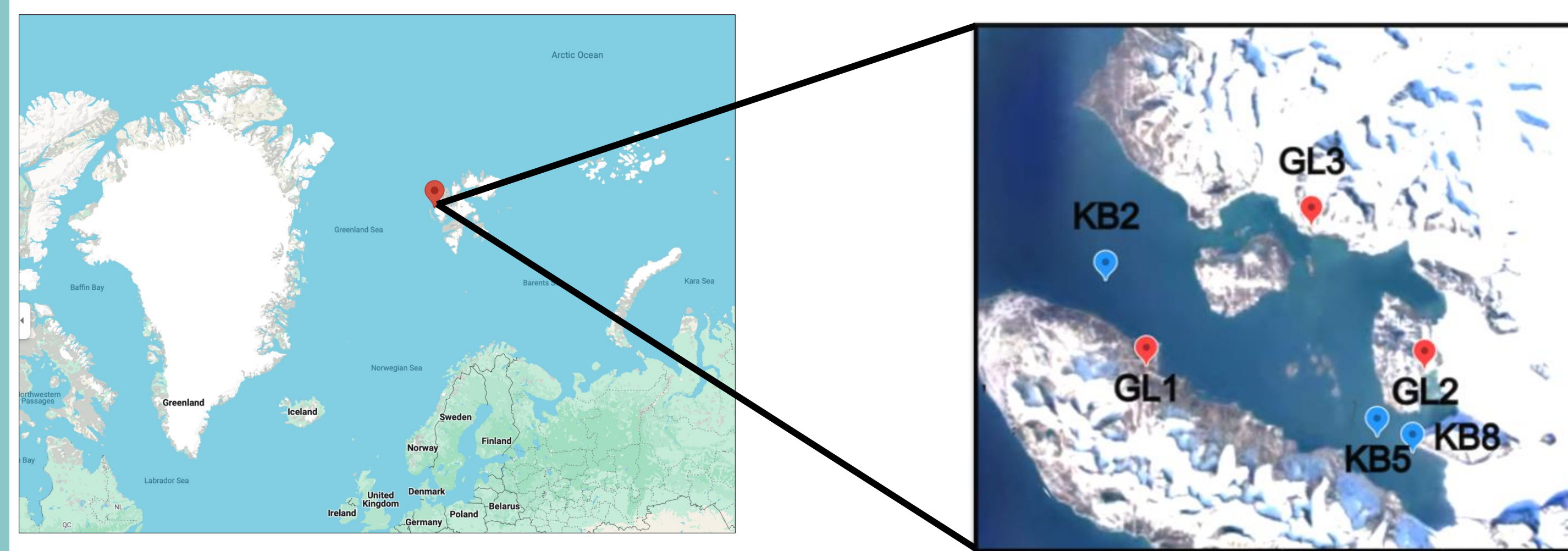
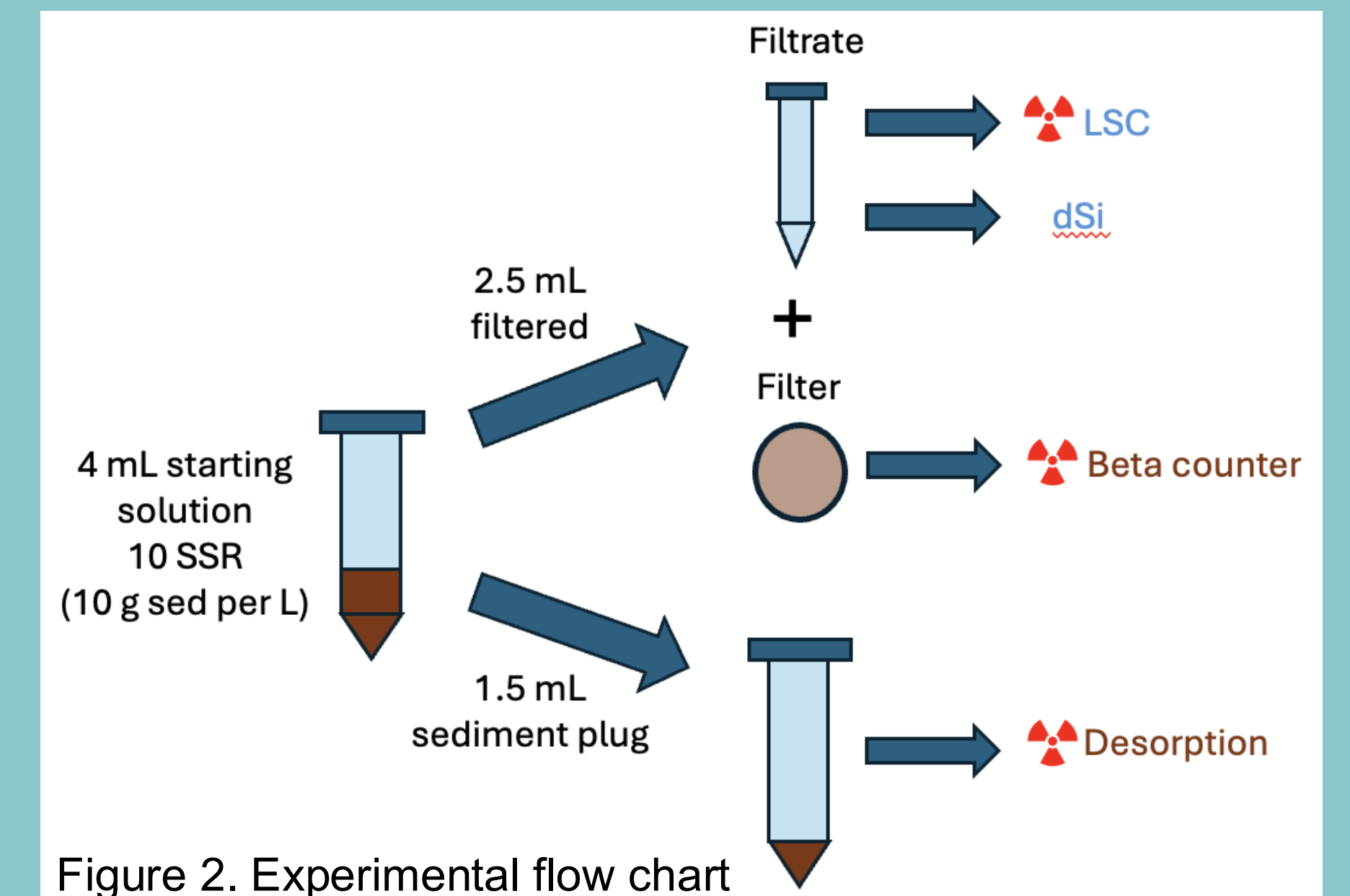


Figure 1. Sample locations in Kongsfjorden, Ny-Ålesund, Svalbard. Blue pins (with KB labels) indicate fjord sample sites, while red pins (with GL labels) indicate glacial river sites. This map was made with Google Earth and Google Maps.



Silica in solution

Dissolved silica (dSi)

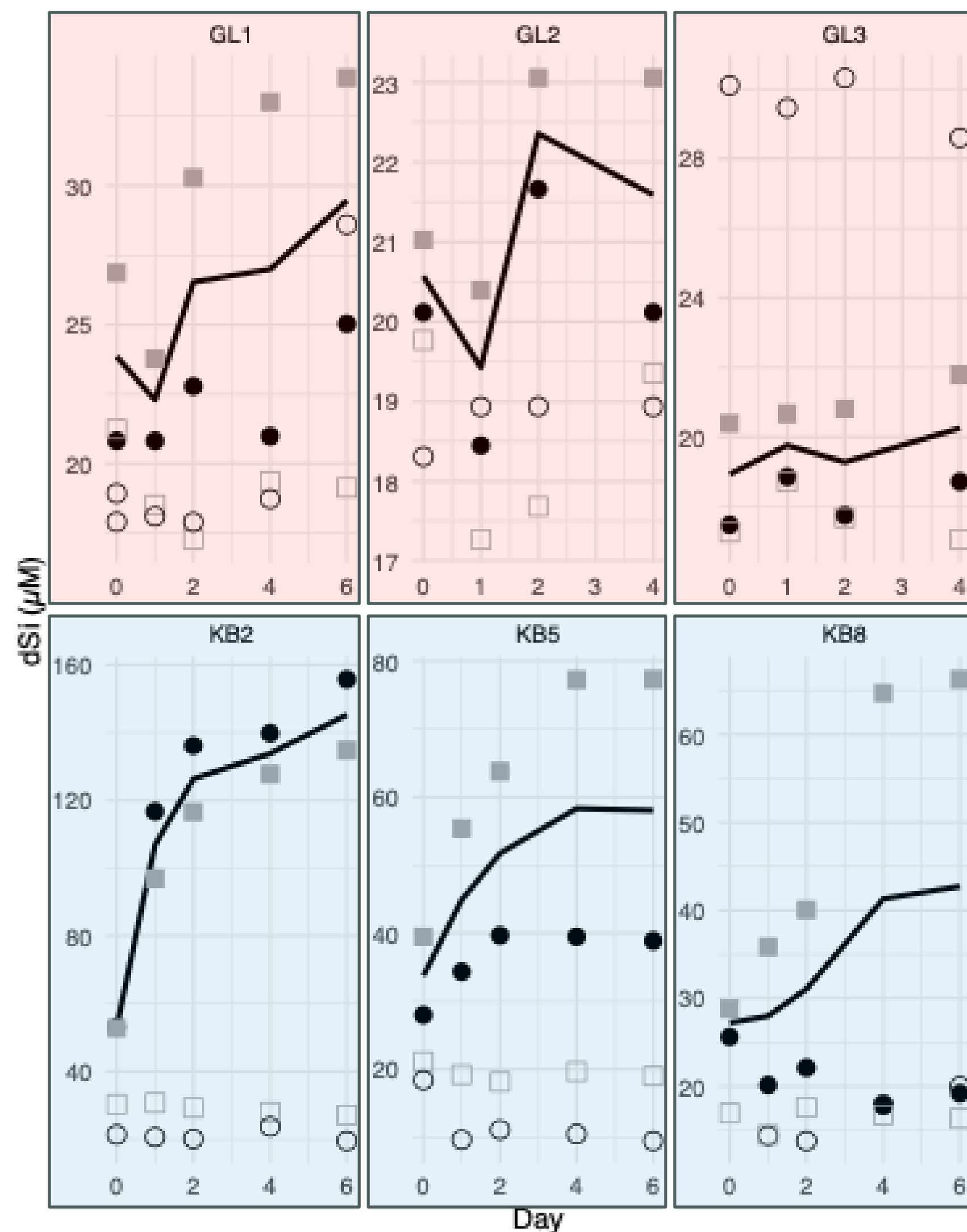


Figure 3. Dissolved silica (dSi) concentrations from time series incubation experiment. Red background indicates glacial river samples, while blue background indicates fjord samples for all figures. Note different y-axis scale.

³²Si - LSC

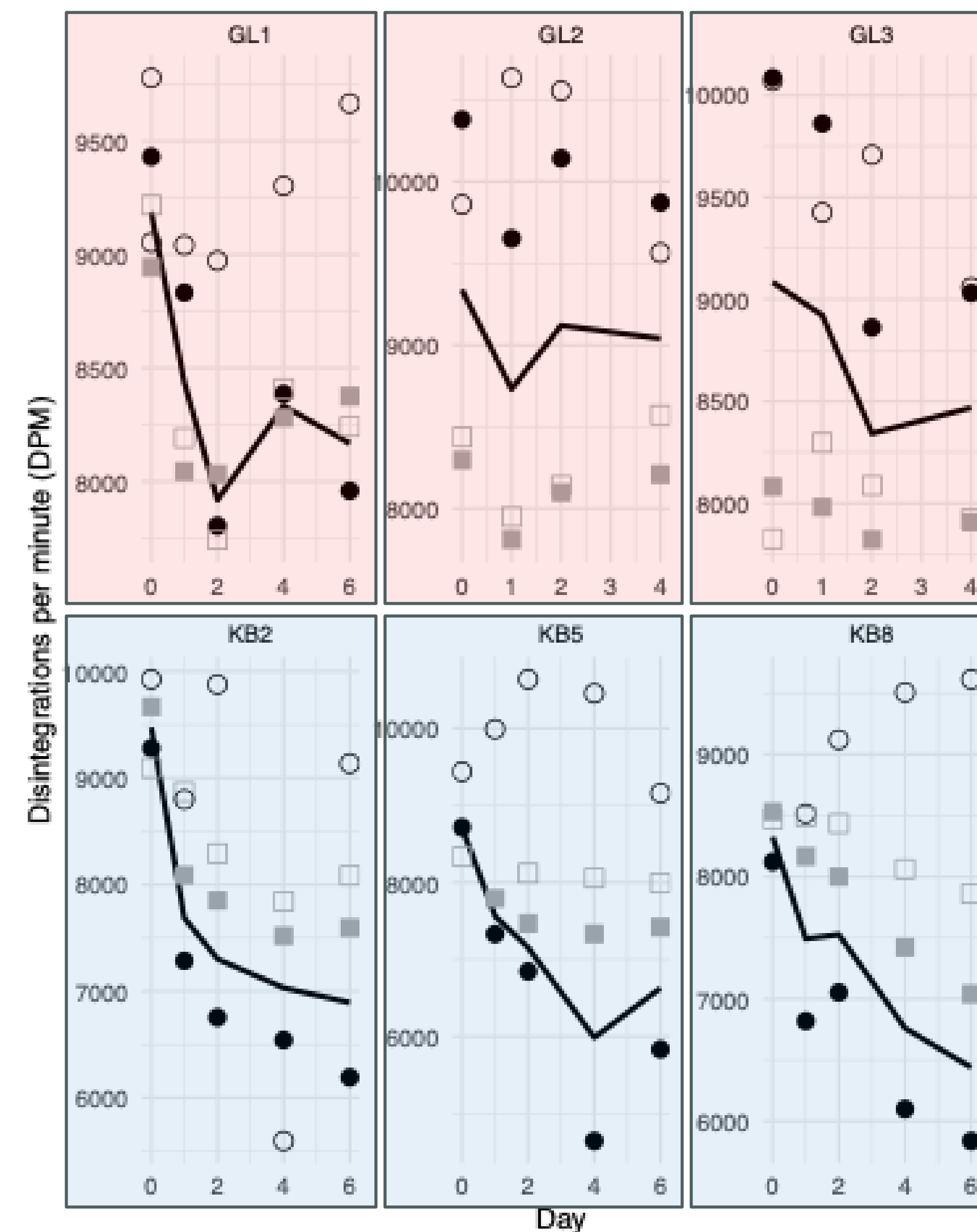


Figure 4. Radioactive ³²Si in the filtrate from time series incubation experiment.

- alive_blank/control
- alive_FSW+sed
- dead_blank/control
- dead_FSW+sed

Trendlines are averages of FSW+sed values only.

Results

The simultaneous accumulation of dSi and removal of ³²Si from solution demonstrates dynamic two-way exchange of both sediment Si uptake and sediment Si dissolution.

Overall, there was an accumulation of ³²Si in the particles, with higher accumulation in fjords.

This suggests that rivers may retain fewer reactive particles, which may be transported into the fjord and possibly to the coastal ocean.

Silica in particles

³²Si - Beta counter

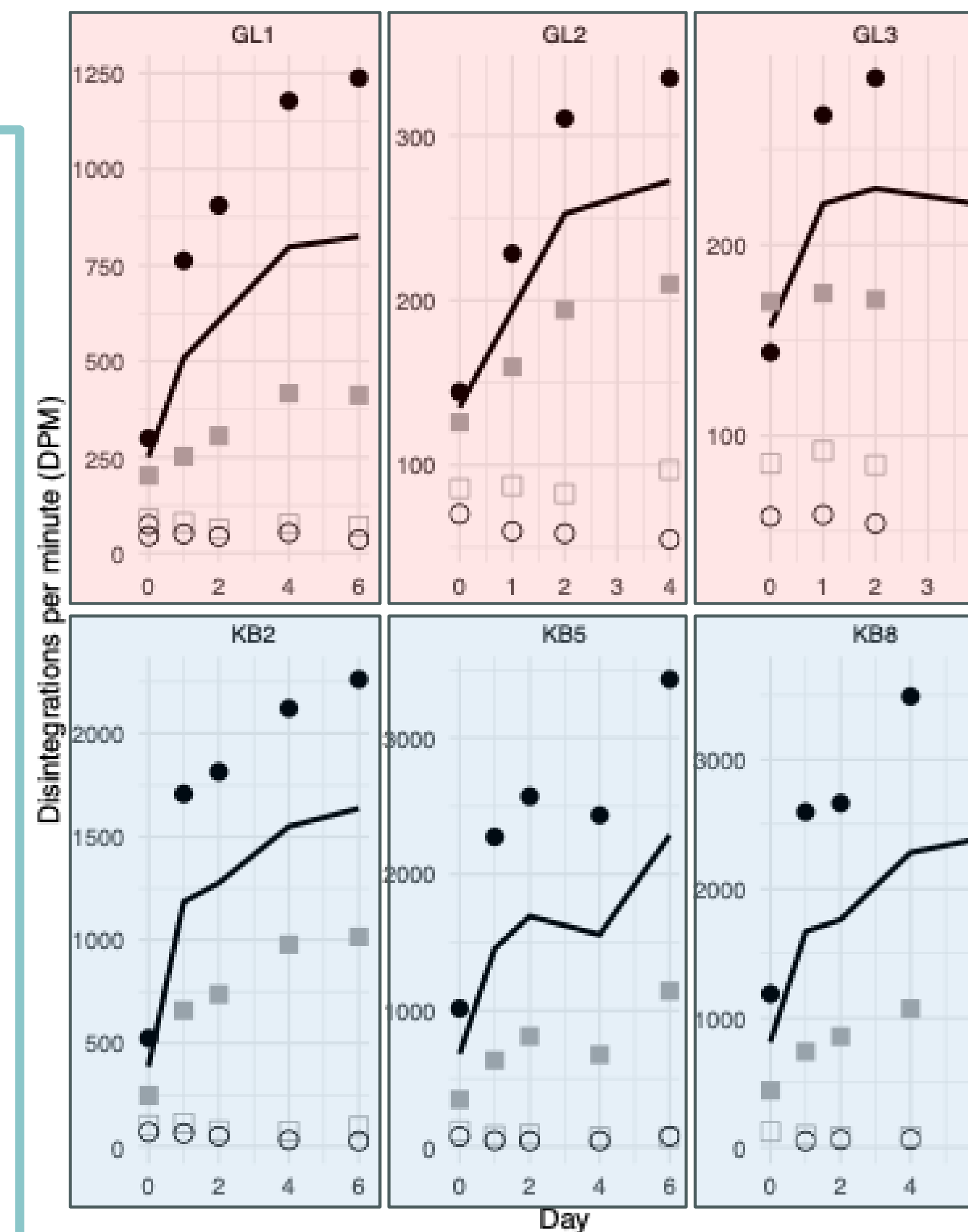


Figure 5. Radioactive ³²Si in particles collected on the filter.

³²Si - Desorption

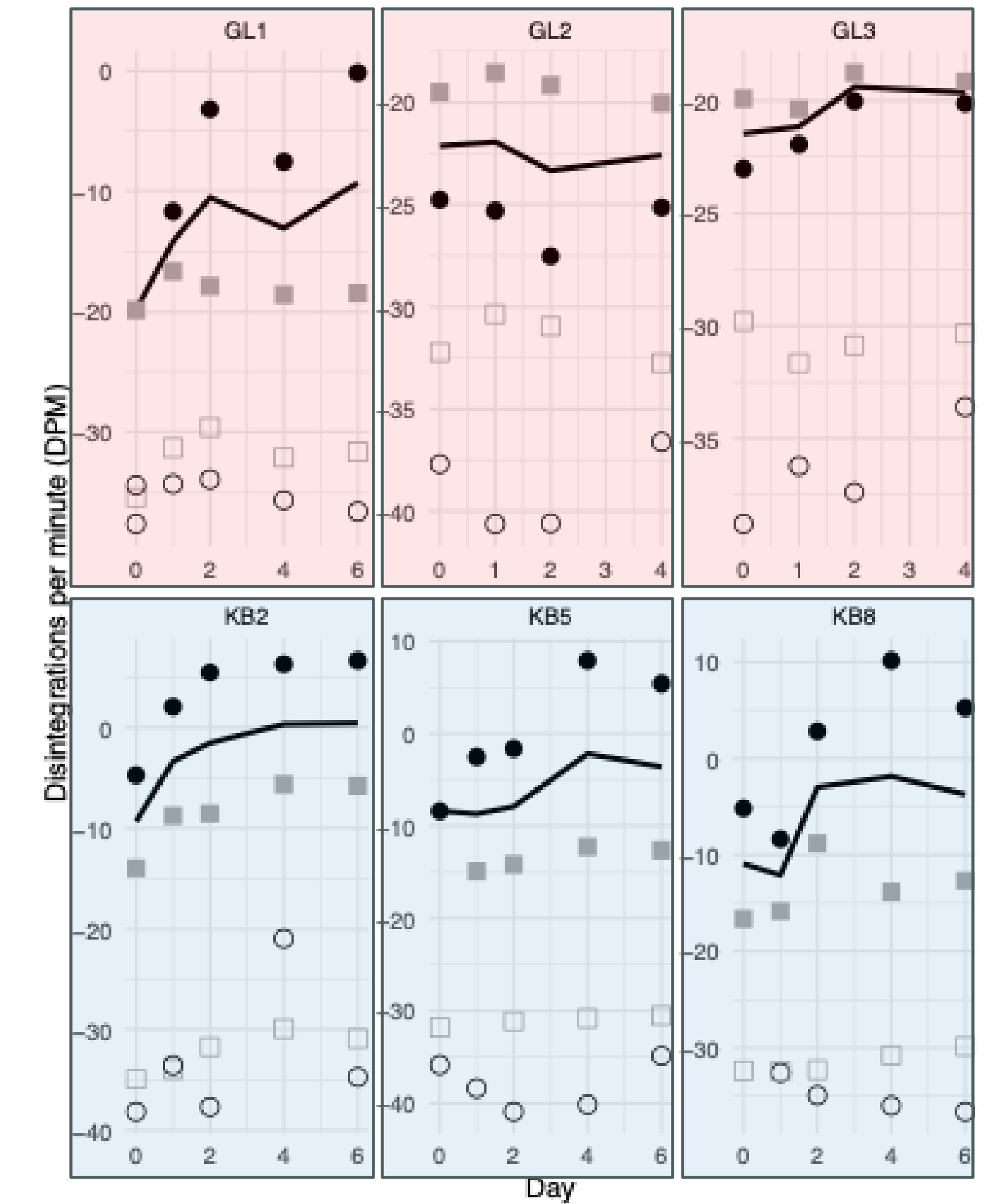


Figure 6. Radioactive ³²Si in particles from the sediment plug.