

Temporal Variability in Sediment Microbial Abundance in the Mississippi River Plume



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Objective

To develop an understanding of the impact of microbial communities on sediment elemental cycling in the Mississippi River Delta.



Map of ample locations in the northern Gulf of Mexico off the coast of Louisiana. Made with Google Earth.

Methods

Sample collection

Sediment cores were collected in September 2024 (Q1, a few days after Hurricane Francine) and January 2025 (Q2, about 4 months after Hurricane Francine) at coastal sites west of the Mississippi River (map above).

Cell abundance

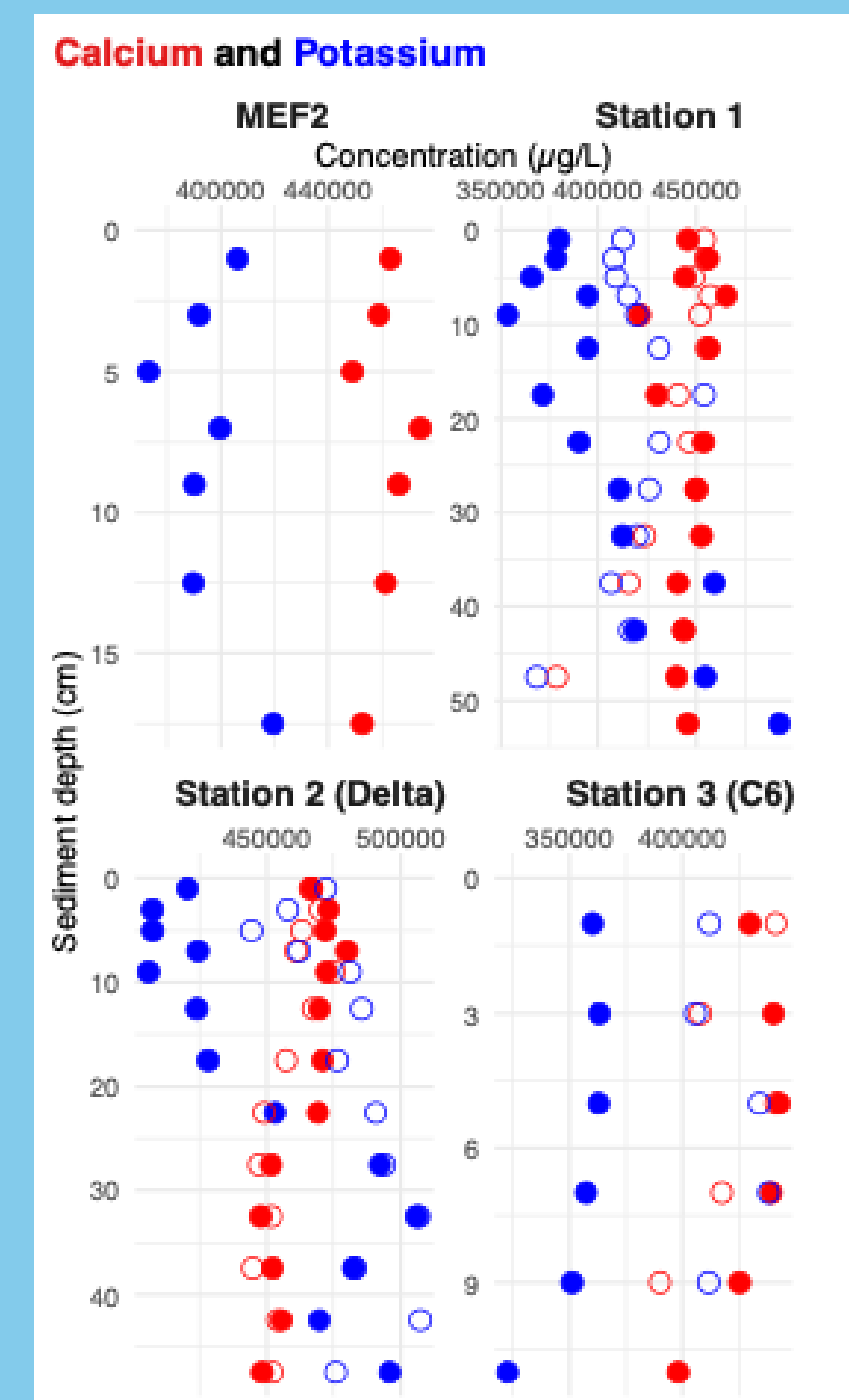
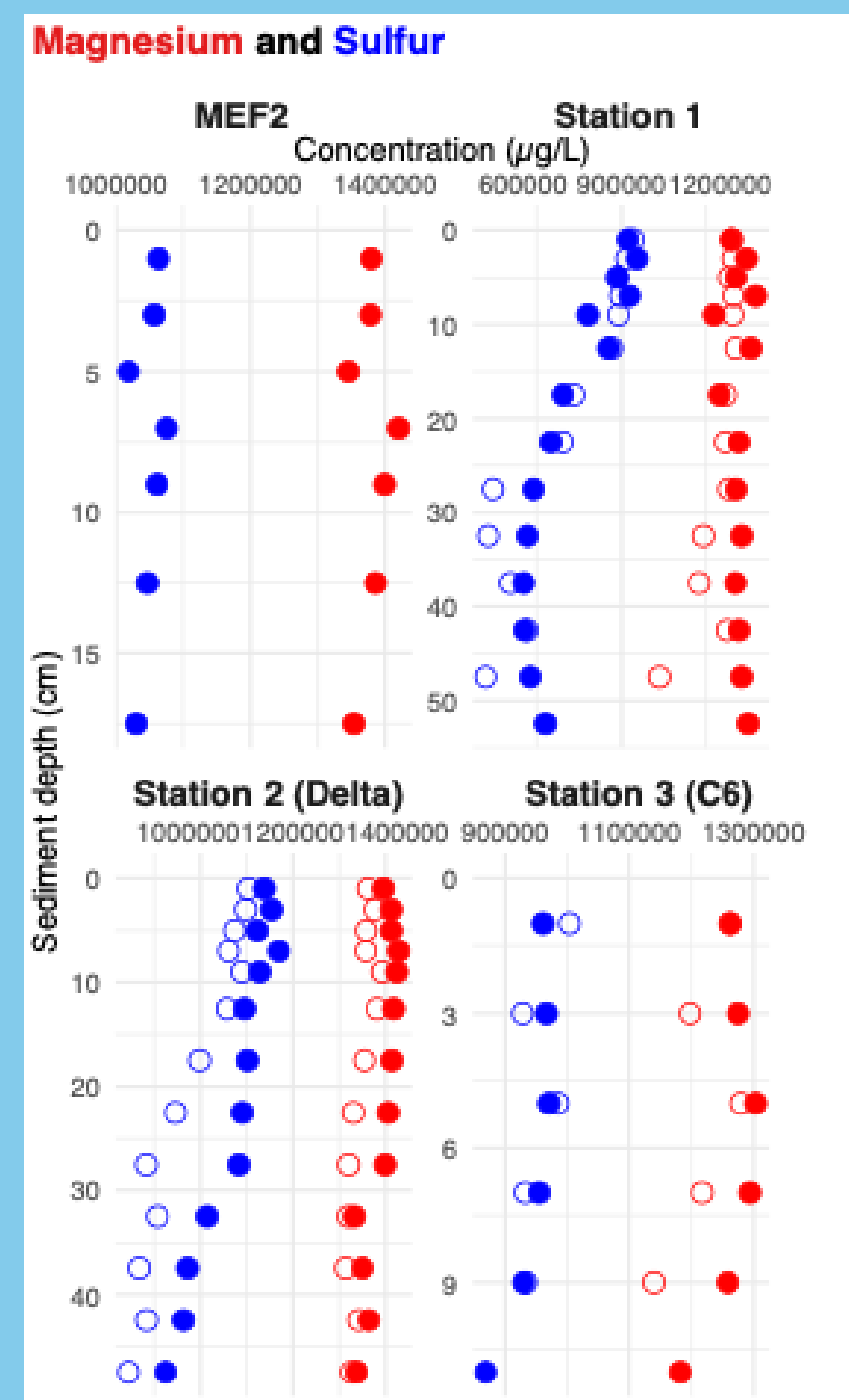
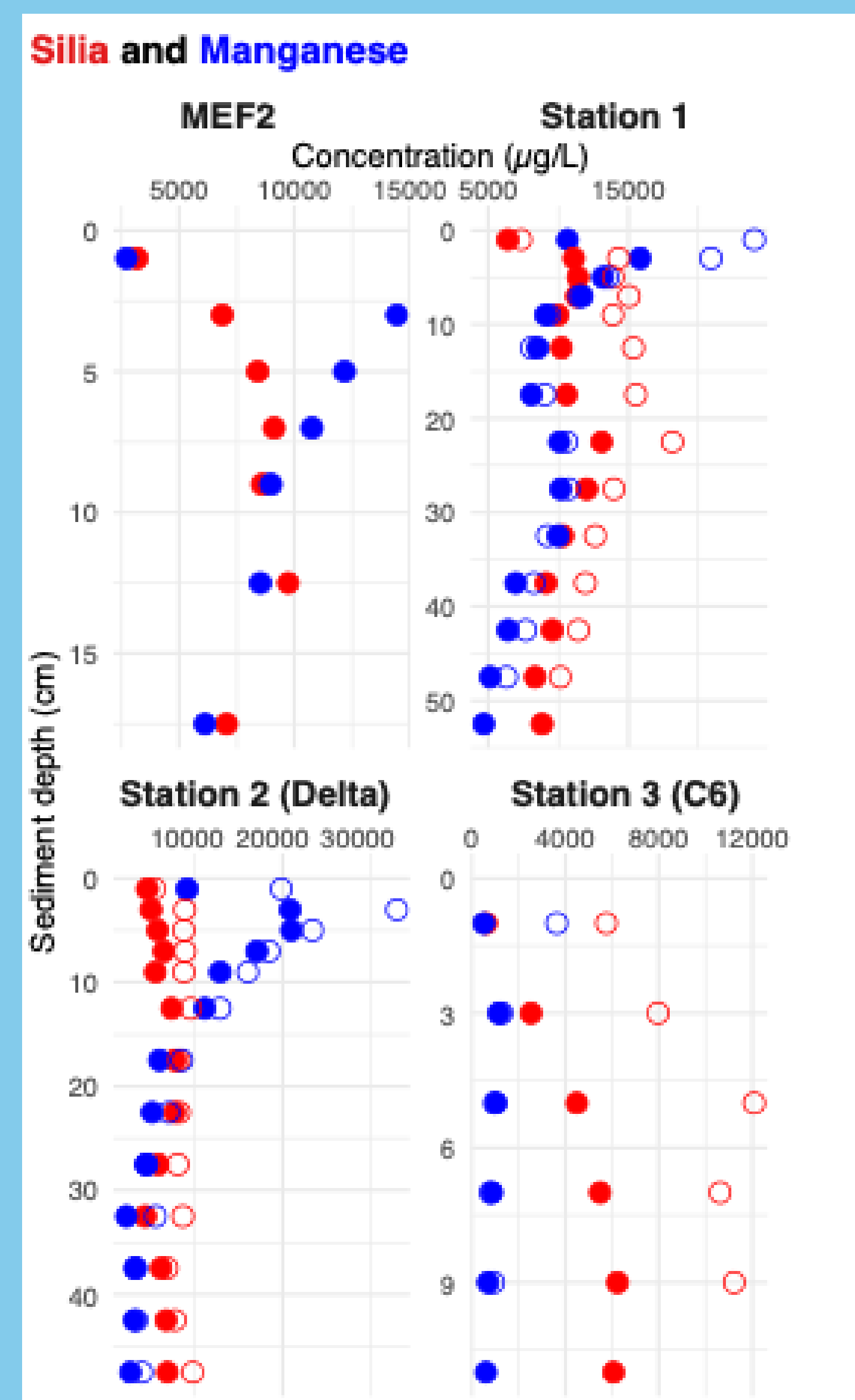
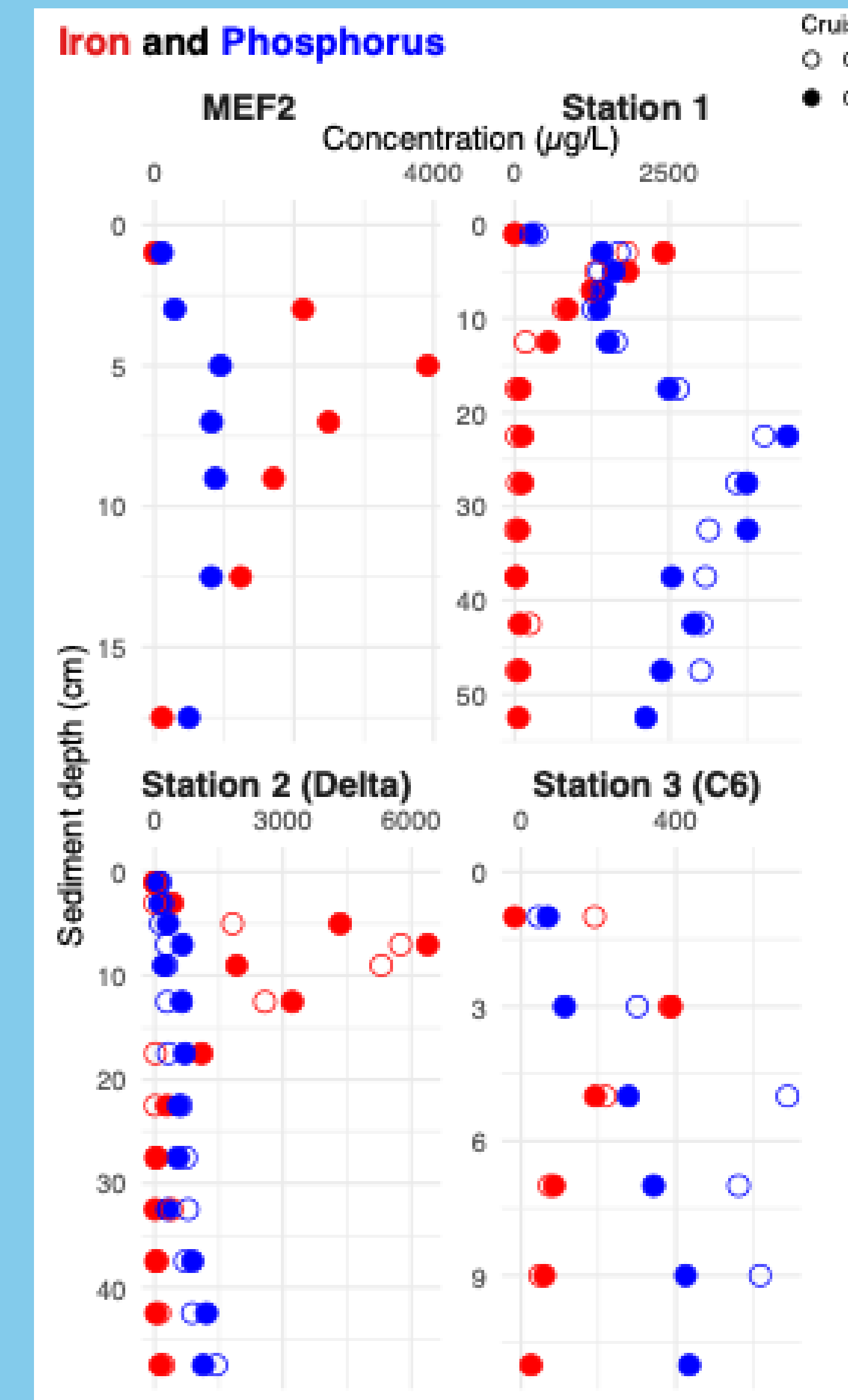
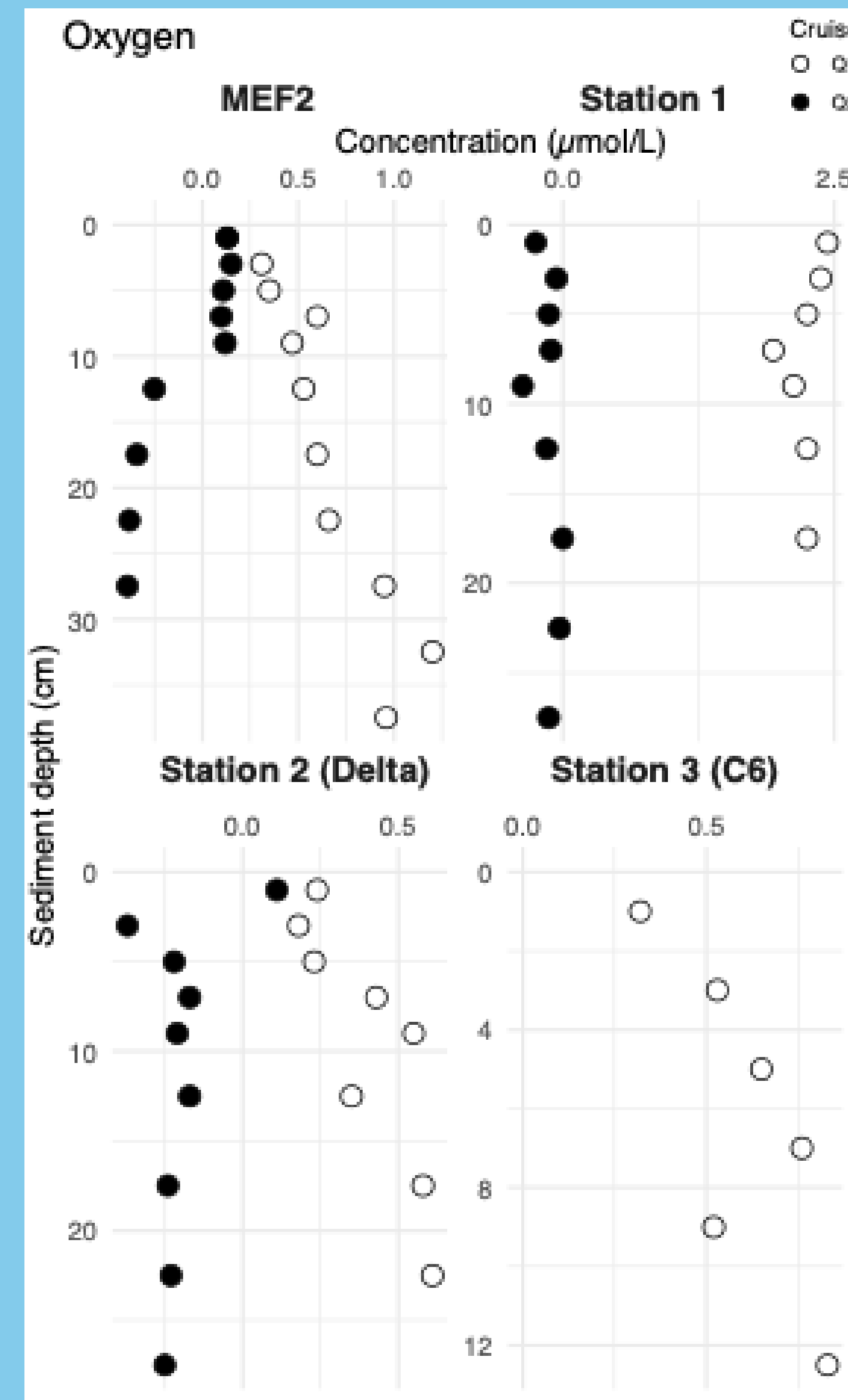
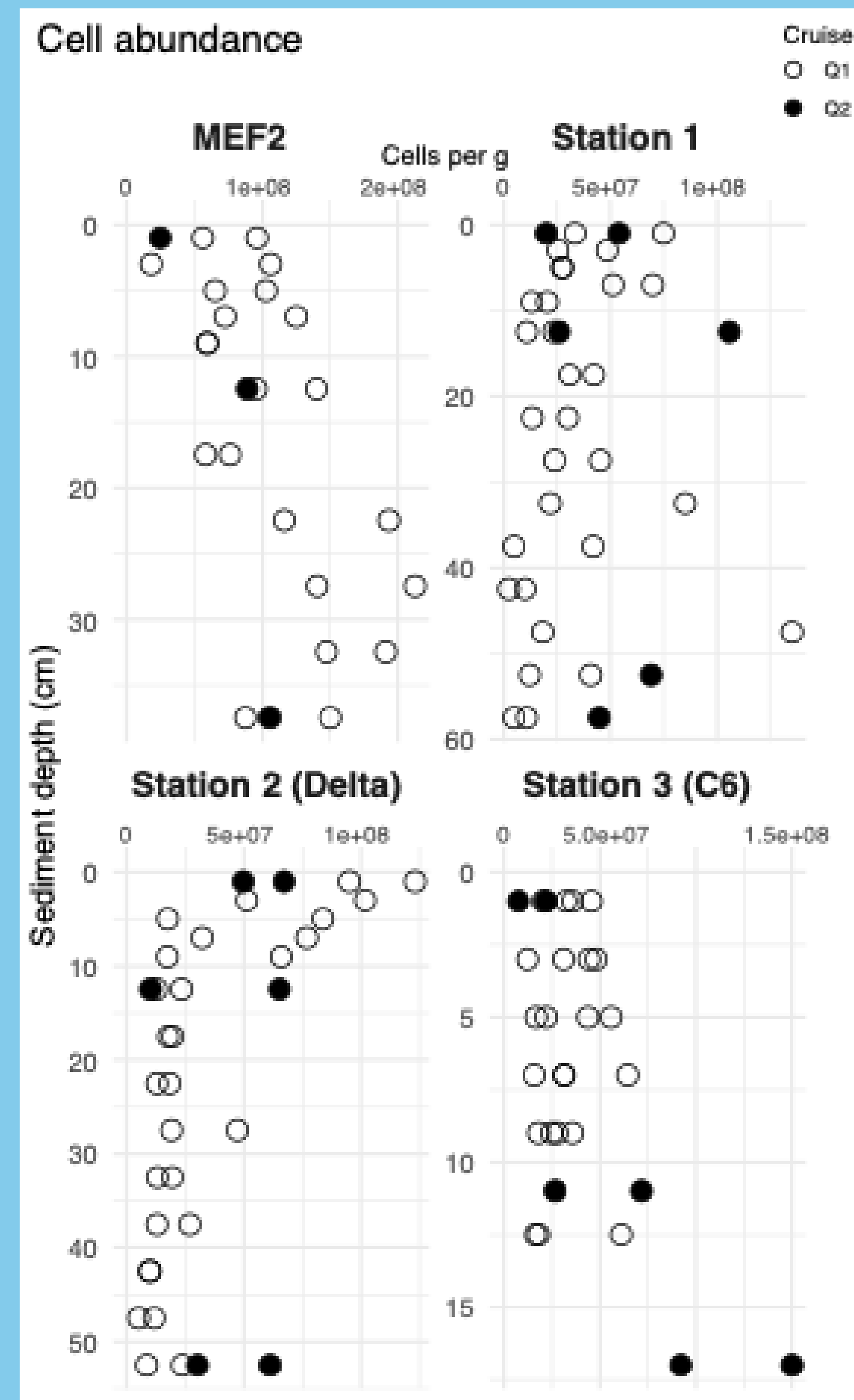
Subsamples from cores were preserved in 4% paraformaldehyde until they were counted on an Attune NxT flow cytometer using SYBR to stain cells.

Oxygen measurements

One core was immediately measured for *in situ* dissolved oxygen concentrations using PreSens Microx 4 oxygen optodes.

Element analysis

A separate core was processed to extract porewater for dissolved metals and macro nutrients, which were analyzed on a high resolution ICP-MS.



Results

Cell abundance was fairly consistent with sediment depth, but sites further east and closer to the Mississippi River outflow appear to have more variation throughout the sediment column.

Dissolved oxygen in the porewater was typically below detection levels except in upper layers of sediment. Oxygen generally decreased with depth starting at around 3-5 cm below surface closest to the Mississippi River and around 10 cm further from the coast.

Metal and macro element analysis

- A decrease in iron concentrations with depth indicates an oxygen minimum zone with increasing microbial activity.
- Silica concentrations had an overall decrease between Q1 and Q2 at two stations.
- Magnesium, sulfur, calcium and potassium concentrations typically decreased with depth, with only phosphorus showing notable difference between cruises.
- Consistent with the redox trends, nitrates and nitrites decreased to below detectable concentrations within the upper layers of sediment, and ammonia increased with depth (data not shown).

Next steps

Extract DNA and RNA from sediment cores for metagenomic and metatranscriptomic analysis to elucidate the abundance and activity of the microbial community. A third cruise is planned for April 2026 to add another timepoint to these data.

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