

Linking Organic Carbon Sources and Cycling with Microbenthic Abundance and Diversity Across the Coastal Shelf of the Mackenzie Delta

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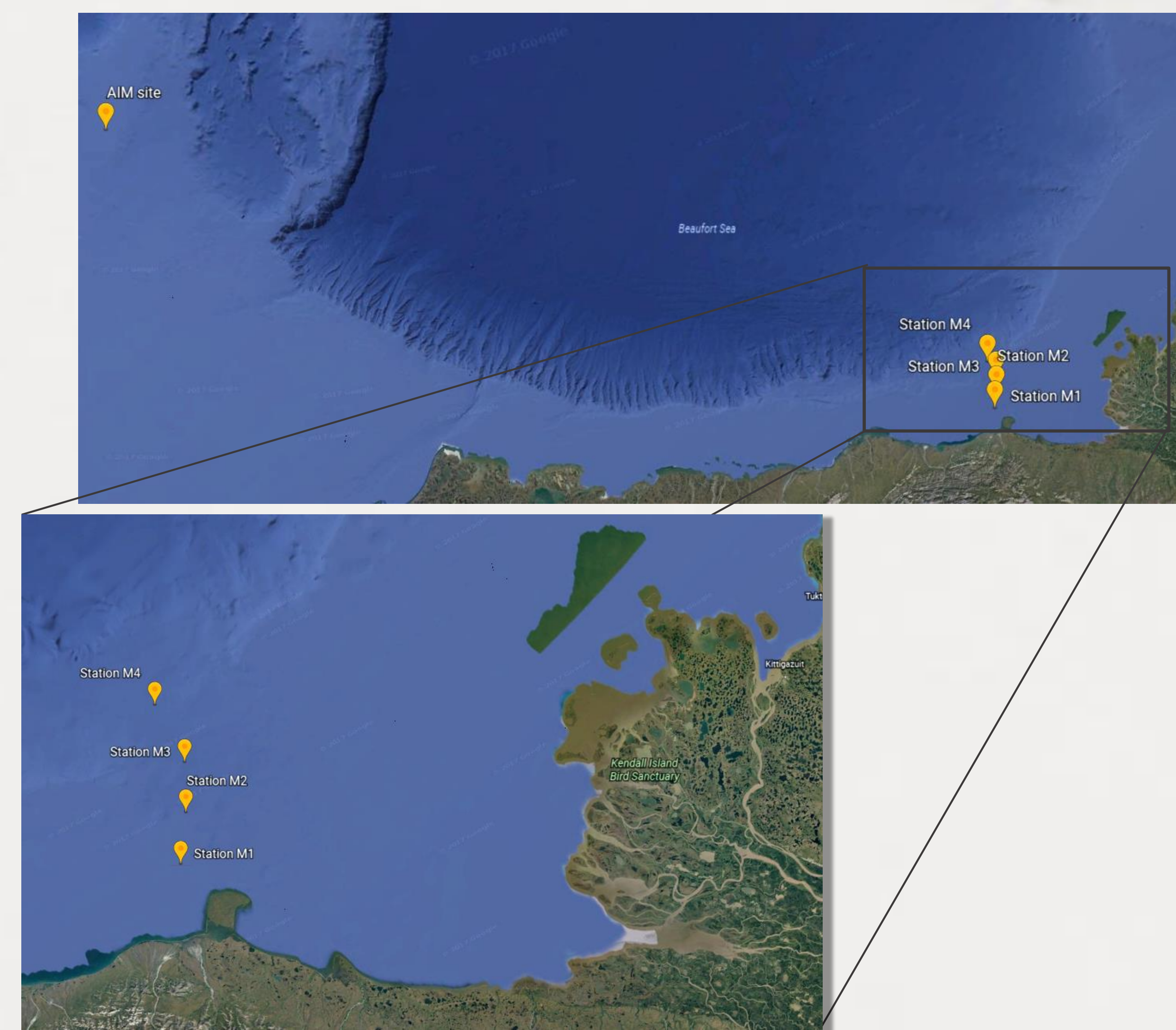


Abstract

During the Arctic spring freshet, the Mackenzie River releases large amounts of dissolved and particulate carbon into the Canadian Beaufort Shelf Sea. The accompanying pulse of nutrients fuels phytoplankton blooms and together with under ice production, contributes a pulse of organic carbon. Regional carbon budgets suggest both may contribute to benthic production. We examined a sediment transect across the western Mackenzie coastal shelf in fall 2016 and the relationship of organic sources with meiobenthic diversity and abundance. Organic biomarker analysis via tandem mass spectrometry constrained the amount and type of organic sources together with total hydrolysable amino acids (THAA) as markers of organic matter lability and cycling. Lipids and amino acids were compared to meiobenthic abundance and diversity. Both organic proxies and meiobenthic abundance showed enrichment at mid-shelf stations with dominant taxa seen as Foraminifera, Polychaeta, Crustacea, and Nematoda. Lipid biomarkers showed significant algal carbon remained in late fall with major contributions by both diatom and dinoflagellates. Total hydrolysable amino acids show increased breadth of structures and contributions were elevated at the mid-shelf stations. Current results suggest that that mid-shelf waters receive relatively higher contributions of labile marine carbon than shallow sites along the eastern Beaufort Sea shelf and despite the large input of terrestrial organic material exiting the delta drive increased meiobenthic diversity and abundance.

Study Area and Sampling

Sample were collect in early October 2016 on the MARES mooring cruise from a transect off the Canadian Mackenzie delta. A sample was also collect further offshore (AIM monitoring site) as comparison with more open ocean arctic conditions.

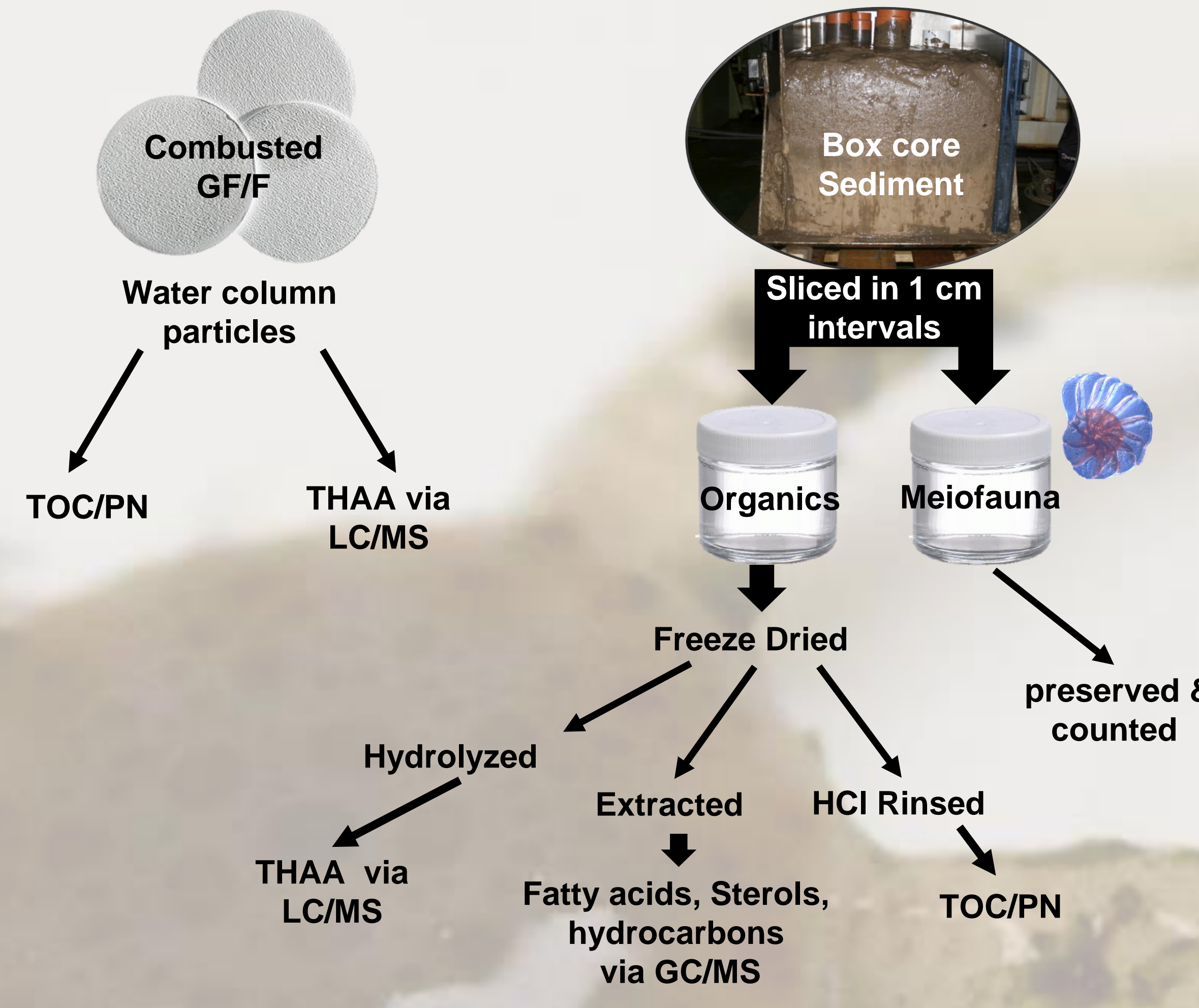


Water column particles and sediments (via box core) were collected at each station for analysis of carbon, grain size, organic biomarkers and meiobenthic abundances.

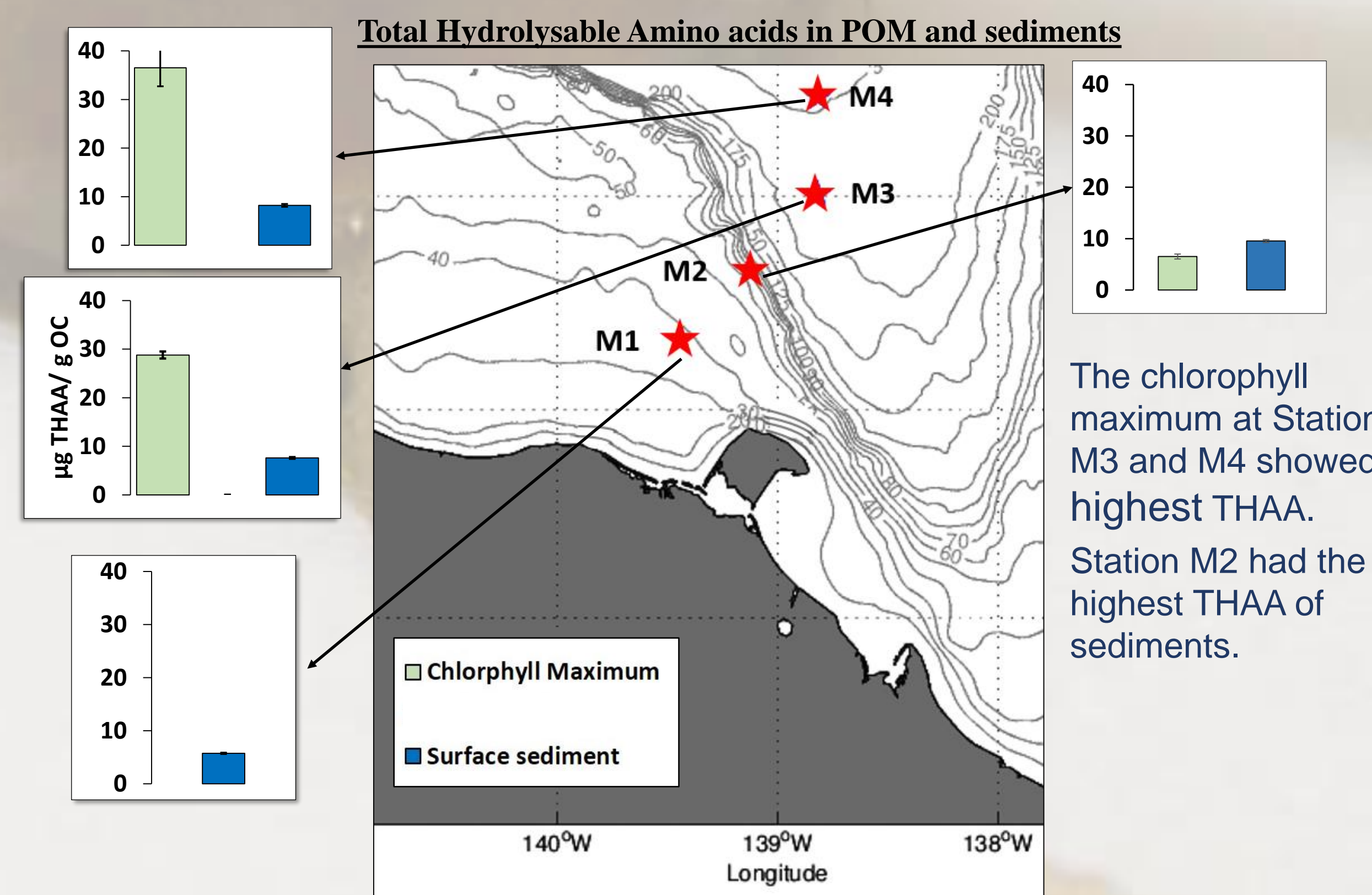
In the Water column, Samples were taken at the same location for all stations. This included the chlorophyll maximum, and the bottom water right about the sediments.

All Sediments were taken using a box core in which the samples were sliced from. This research focuses on the top 1 cm of sediment.

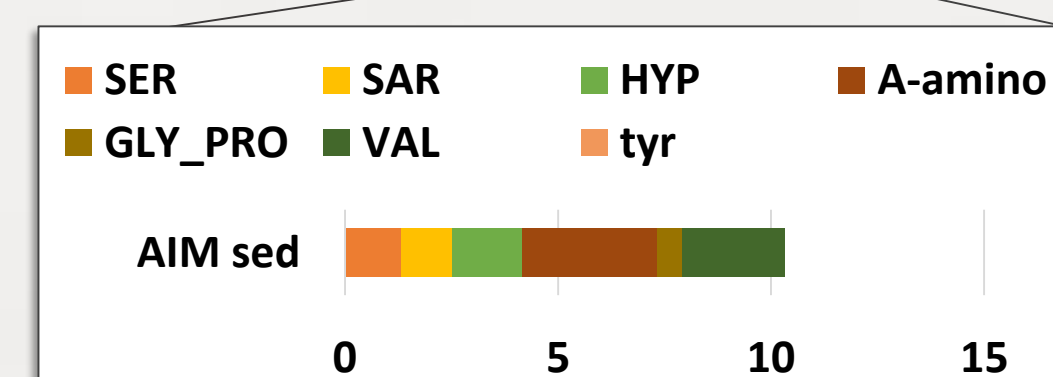
Methods



Results



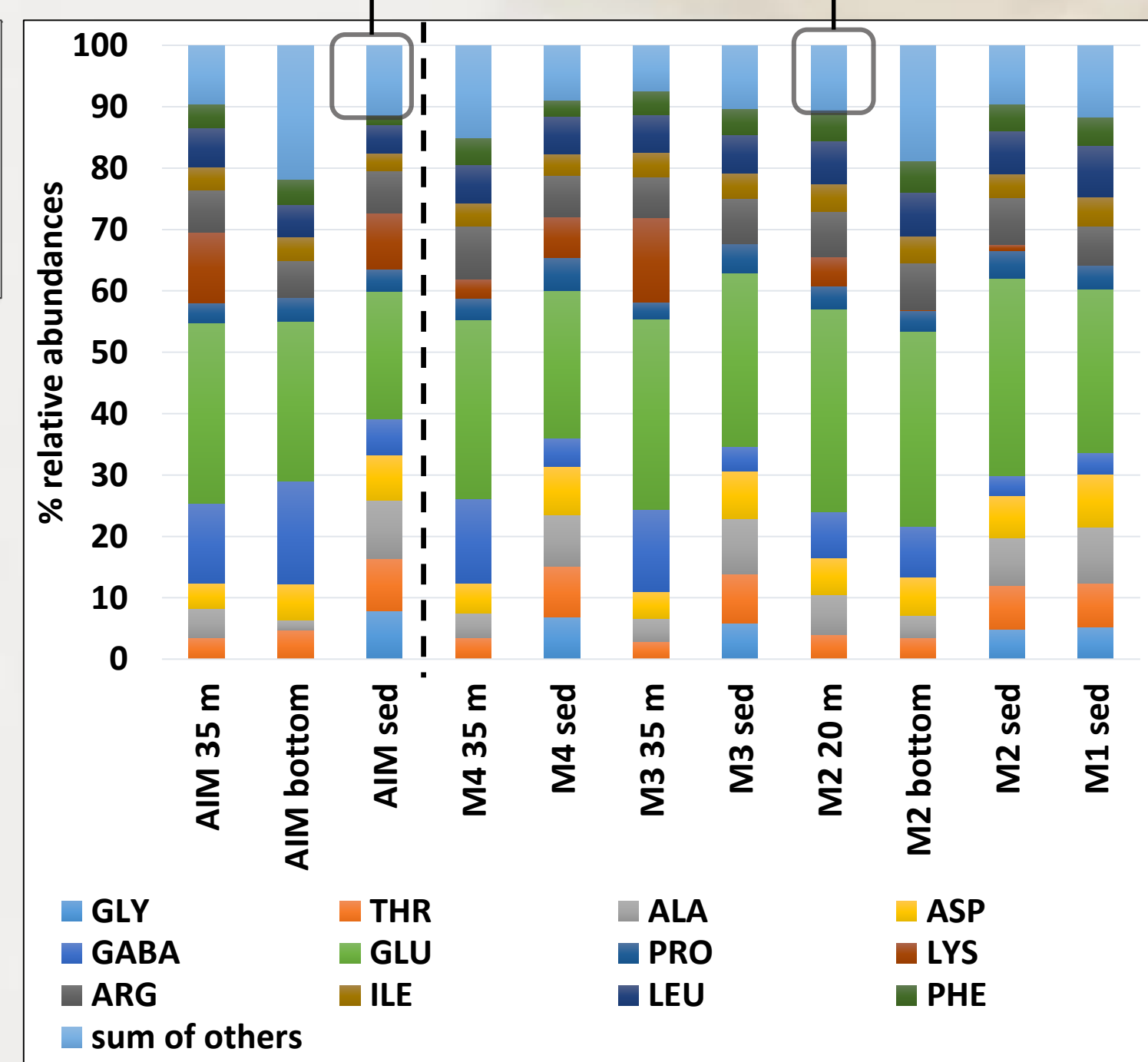
The chlorophyll maximum at Station M3 and M4 showed highest THAA. Station M2 had the highest THAA of sediments.



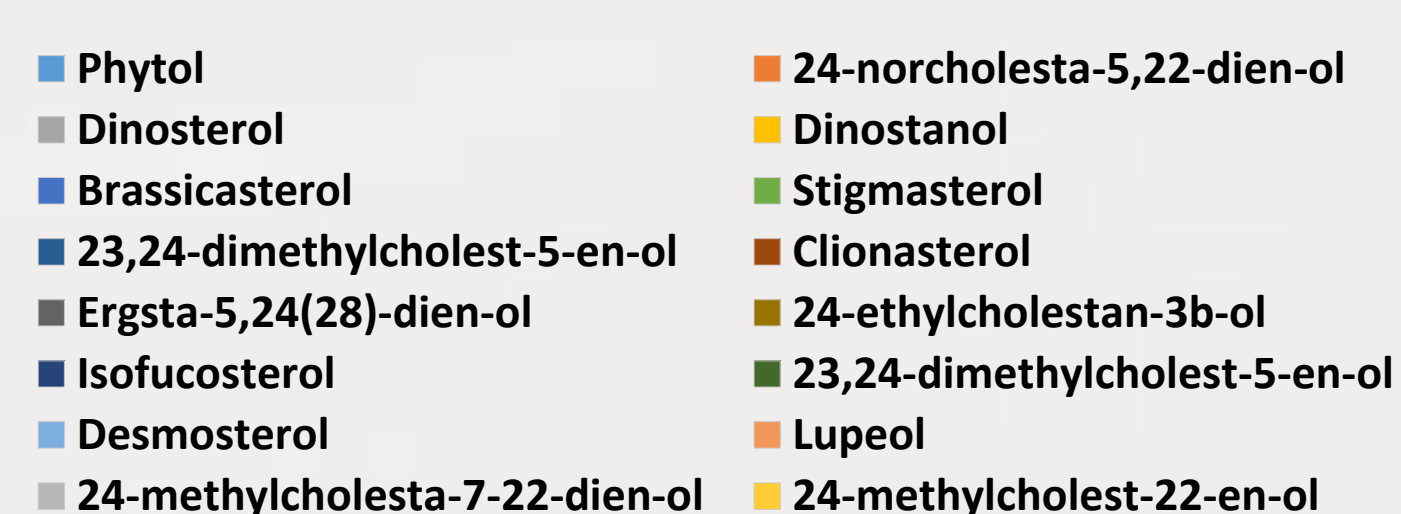
Distributions of THAA showed increases in GLY and other diatom marker amino acids in the sediment.

The low carbon content suggests that all non-protein amino acids were produced in-situ rather than an indication of degradation state in sediments.

Sediment Fatty acid biomarkers

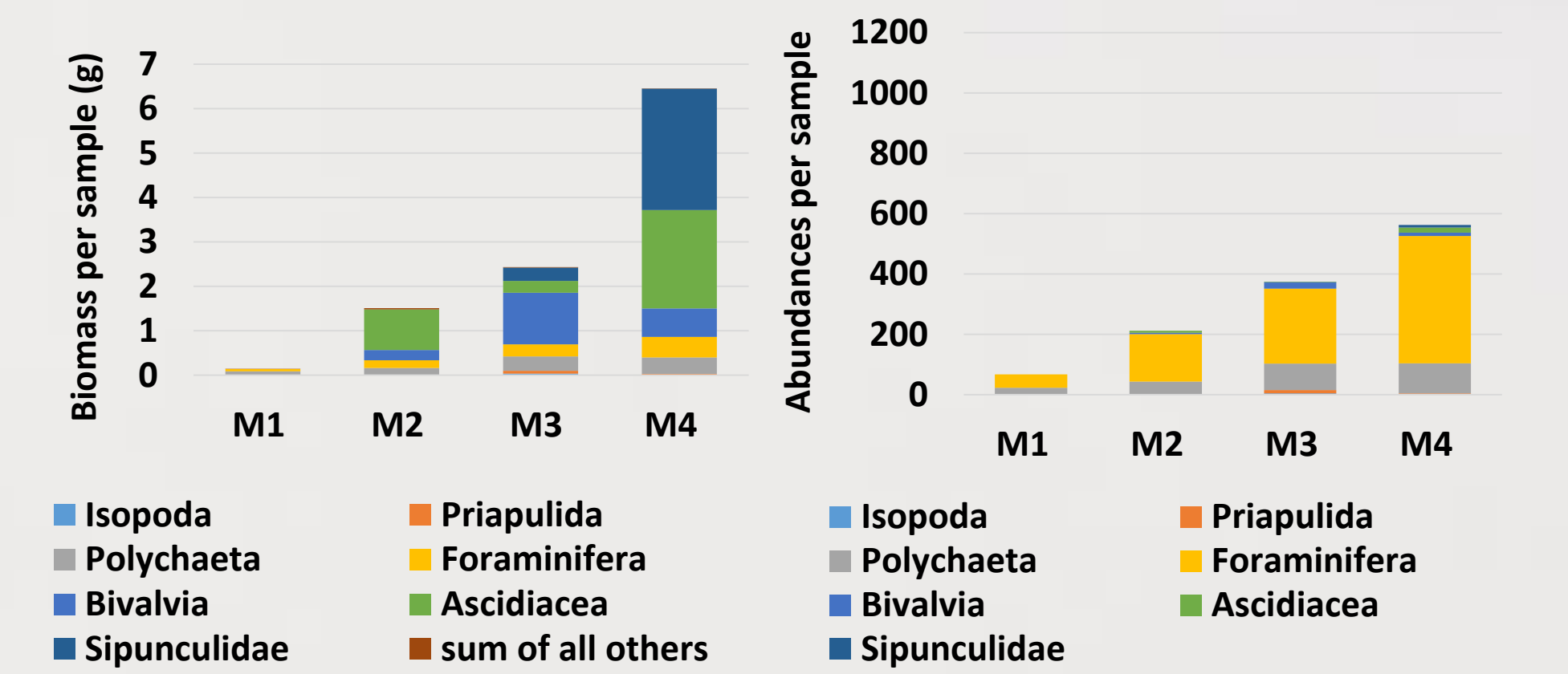


Phytol and sterol biomarkers



Major meiobenthic phyla (as biomass) and corresponding abundances

The most abundant meiobenthic phyla are not majority of the biomass

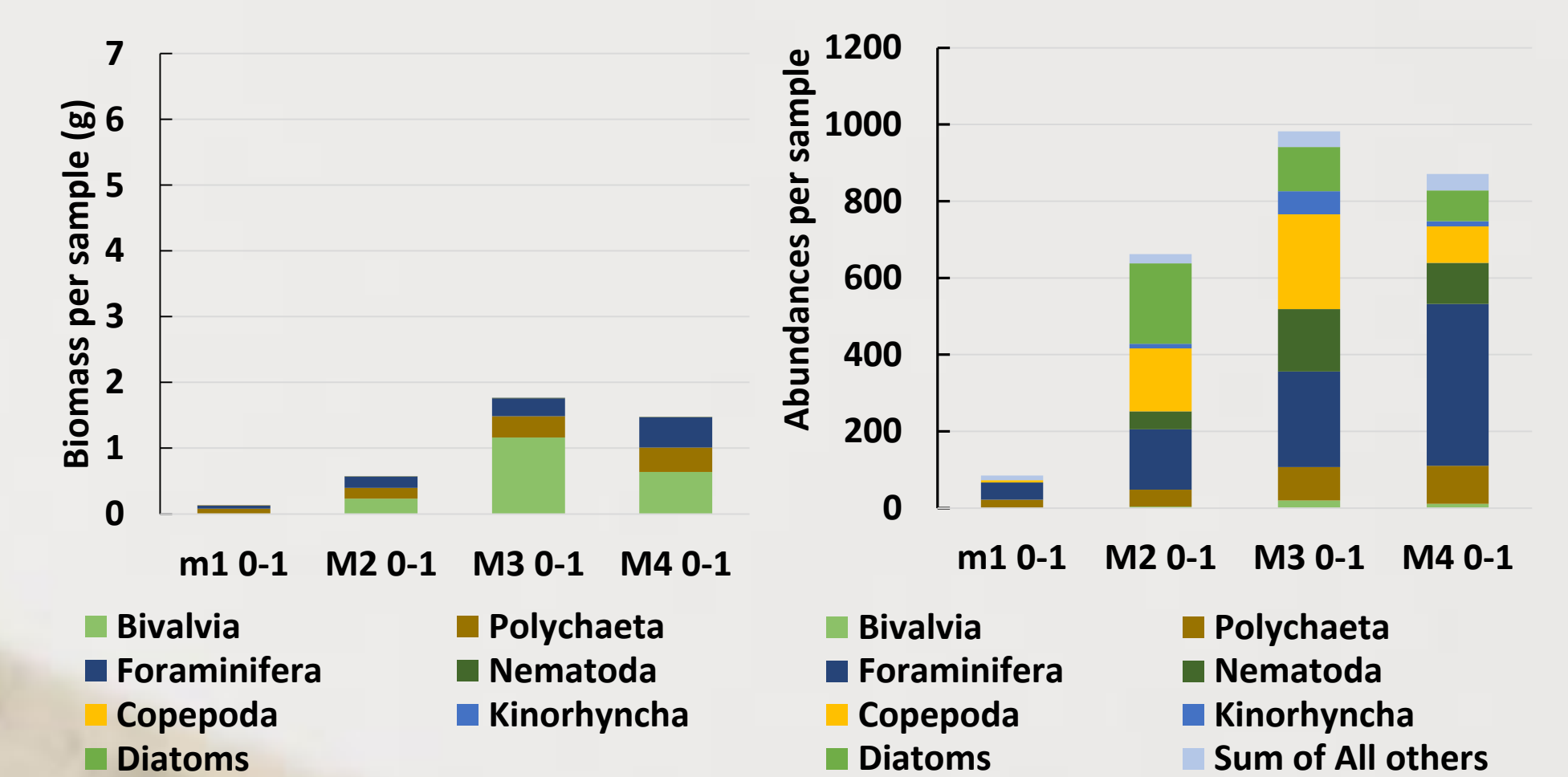


Diatom frustules were highest at the mid-shelf stations (M2 and M3)

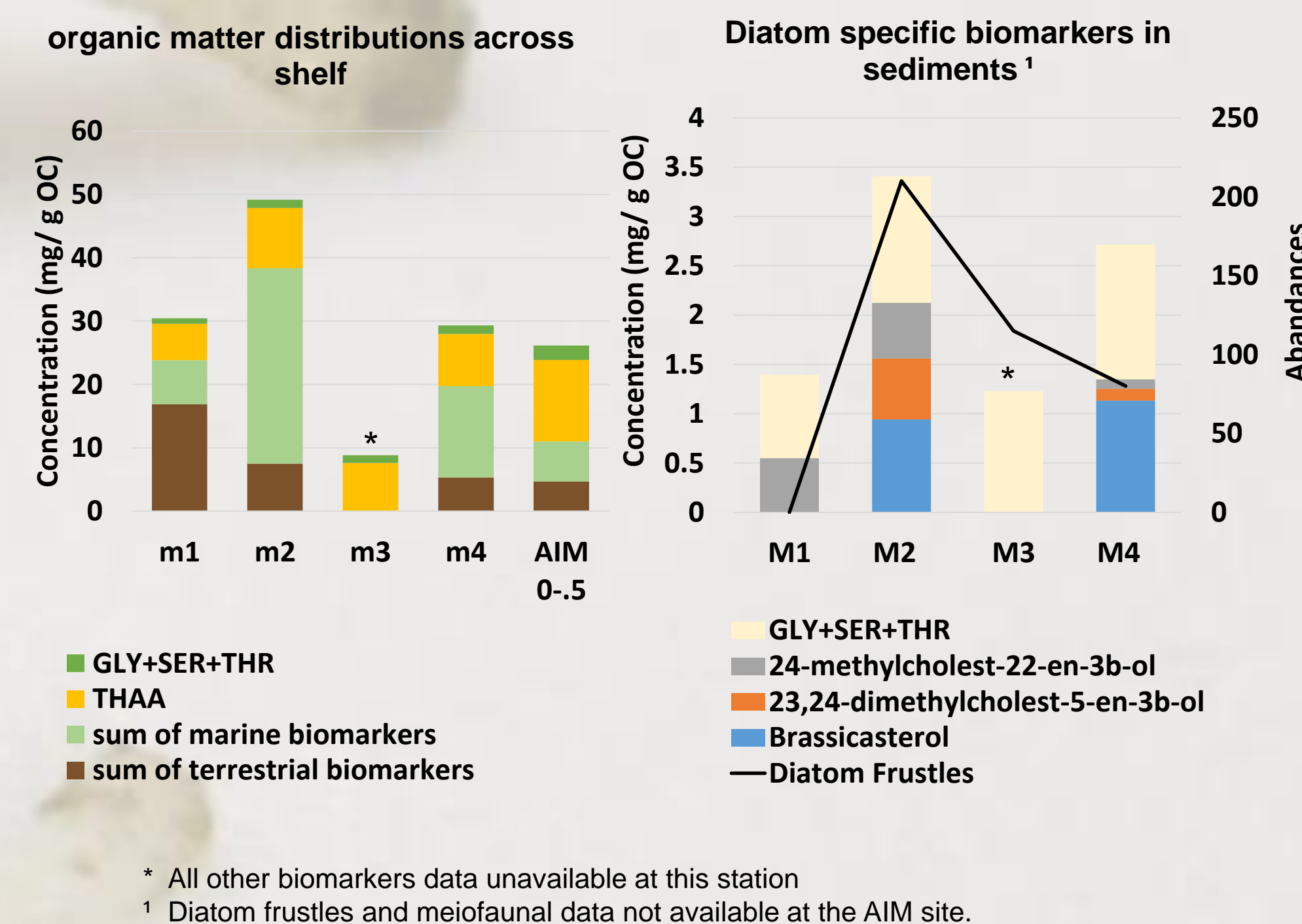
Contributions by forams increased further offshore

Station M3 showed most diverse meiobenthic. Detrital grazers as copepods, Polychaetes, and Nematodes were most common at M3.

Seven most abundant meiobenthic phyla and biomass



Terrestrial biomarkers are highest at the station closest to shore (M1). Mid-shelf stations are highest in marine biomarkers and continue elevated offshore. Diatom specific markers are highest at shelf edge



Observations and Summary (so far!)

- Organic carbon, total THAA and detrital grazers are highest at the mid-shelf stations (M2, M3)
- Sediment THAA and carbon show highly degraded (high non-protein amino acids) low carbon content materials that reflect diatom inputs (GLY, SER, THR)
- Foraminifera phyla increases across the shelf to deeper waters
- In early October (mid-fall), sedimentary organic carbon reflects significant water column production input with lowered terrestrial materials.
- Lipid and fatty acid biomarkers reflect increased algal inputs to mid-shelf sediments, the majority of which appears as diatoms with lower inputs from other phytoplankton.

References

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Keil, R., Tsamakis, E & I. Hedges, J. (2000). Early diagenesis of particulate amino acids in marine systems. Pp 69-82.

Acknowledgements

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