Fate of Terrigenous Nitrogen in Arctic Shelf Sediments-An update

Emma Burns[1], George Wolff[2], Rachel Jeffreys[2], Robert Sparkes[3], Bart van Dongen[1]

[1]University of Manchester, United Kingdom, [2]University of Liverpool, United Kingdom, [3]Manchester Metropolitan University, United Kingdom

MANCHESTER 1824 The University of Manchester

UNIVERSITY OF LIVERPOOL

Changing Arctic Ocean NERC

1. Introduction

- The Arctic is warming twice as fast as the rest of the planet[1] leading to temperatures↑, sea ice[2]↓, coastal erosion[3]↑ and river run off[4] ↑.
- Organic Carbon displays a less conservative behaviour- release as CO_2 ↑ creating a **positive feedback for climate change**[5,6].
- Terrestrial organic nitrogen (TerrON) is a **dominant source** of bioavailable nitrogen (N) in the oceans[7].
- However is remains unclear how changes in the availability and source of TerrON can impact the **Arctic food web**.

2. Study Areas and Methods

- Area 1: East Siberian Arctic Shelf (ESAS). Receives large amounts of **TerrON** transported via rivers and from coastal erosion[5,8](Fig 1). Samples collected during the ISSS-08 and SWERUS-C3 campaigns.
- Area 2: The Fram Strait (FS) and Barents Sea (BS; Fig. 1). Influenced by large water masses entering the **Arctic Ocean** and terrestrial inputs from Greenland/Norway. Samples collected during the JR16006 and JR17005 campaigns.
- Samples were analysed for stable isotopes, $\delta^{13}C$ and $\delta^{15}N$, and pyrolysis was used to analyse the macromolecular composition.

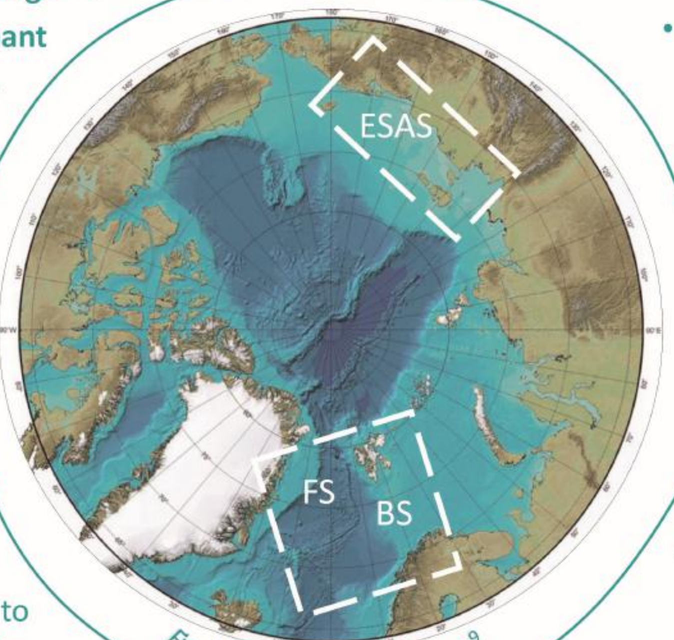
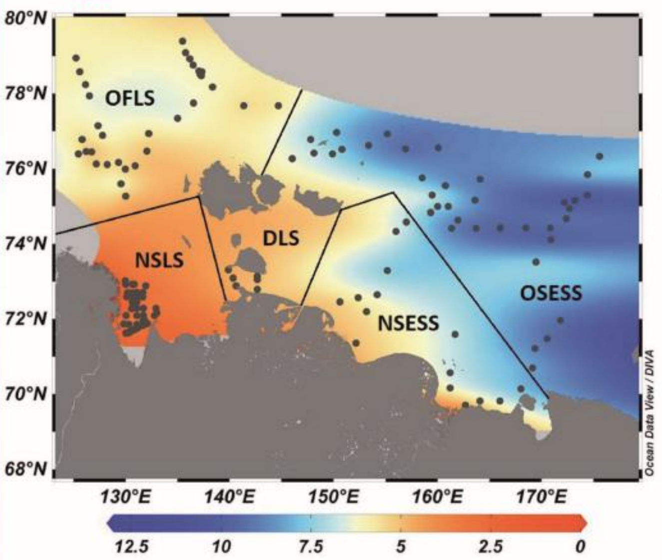


Fig. 1 Regions of study focus[9]
ESAS (East Siberian Arctic Shelf), FS (Fram Strait), BS (Barents Sea)

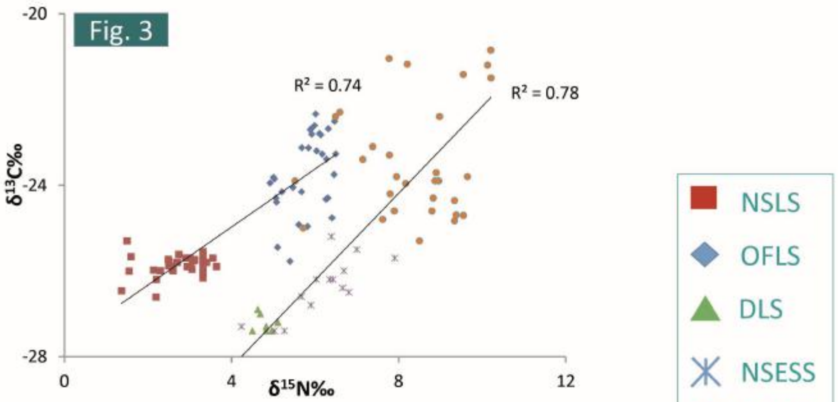
3. ESAS Results

- $\delta^{15}N$ (Fig 2.) shows an enrichment with increasing distance from the coast. The most depleted values found in the nearshore Laptev Sea region (1.4‰) and most enriched found in the offshore East Siberian Sea region (10.2‰).
- Comparisons of $\delta^{13}C_{OC}$ *vs* $\delta^{15}N$ (Fig. 3) and phenol to pyridine *vs* $\delta^{15}N$ (Fig. 4) indicates a comparable fate for the TerrOC and TerrON.
- Clear differences are shown in the $\delta^{15}N$ signal of the TerrON transported from the different regions (Laptev Sea and East Siberian Sea, Fig. 3).
- $\delta^{15}N$ offshore values remain substantially different in both regions, likely indicating a transfer of the terrestrial signal into the Arctic food web.



Regions Defined:
NSLS = Nearshore Laptev Sea
OFLS = Offshore Laptev Sea
DLS = Dmitry Laptev Strait
NSESS = Nearshore East Siberian Sea
OSESS = Offshore East Siberian Sea

Fig. 2 $\delta^{15}N$ Isoscape of ESAS, with regions defined and corresponding symbols to Fig.3 and 4, combined data with data from Sparkes, R. B. et al. (2016) made in ODV[11]



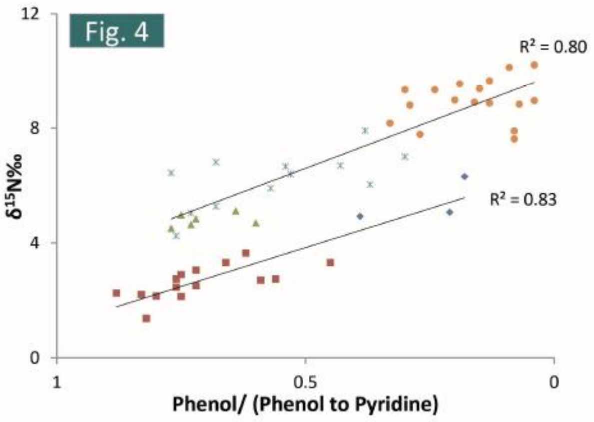


Fig. 3 $\delta^{13}C_{OC}$ Vs. $\delta^{15}N$ correlation plot

Fig. 4 $\delta^{15}N$ Vs. phenol to pyridine ratio correlation plot.

4. Fram Strait and Barents Sea

- $\delta^{15}N$ enrichment is highest at station F21 (6.6‰) and most depleted at station B1 (4.05‰, Fig 5.)
- The highest phenol to pyridine ratios are at station B11 (0.4) and lowest at F21 (0.07, Fig. 6).
- Preliminary results suggest a similar relationship between both parameters as observed in the ESAS, highlighting a potential impact on the **Arctic food web** in this region.
- Unlike the ESAS the Barents Sea and Fram Strait do not have clear land to sea transects in both the $\delta^{15}N$ and phenol to pyridine ratio.

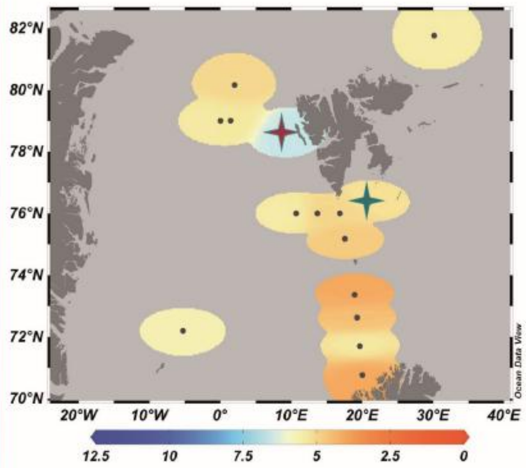


Fig. 6 $\delta^{15}N$ isoscape map of the Barents Sea and Fram Strait. Station F21 indicated with ✦ and B11 with ✦, made in ODV[11]

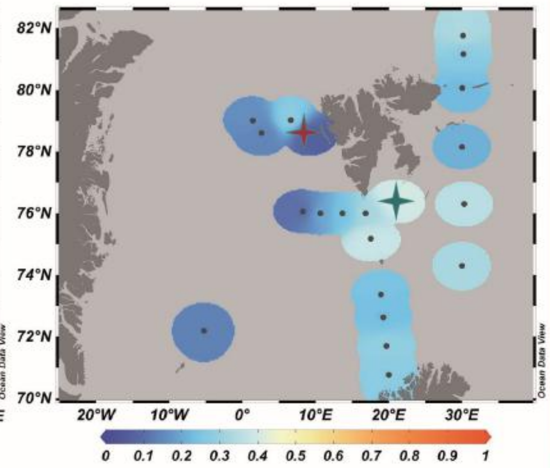


Fig. 7 Phenol to pyridine ratio map of Barents Sea and Fram Strait including data from [12]. Station F21 indicated with ✦ and B11 with ✦, made in ODV[11]

6. Conclusions and Future Work

- Bulk analysis indicates an **influence of terrestrial organic nitrogen** on the Arctic isoscape in the ESAS , Barents Sea and Fram Strait regions.
- However, bulk analysis of $\delta^{15}N$ can be influenced by many factors such as inorganic nitrogen
- To allow for a better understanding, a **compound specific isotope analysis of amino acids (CSIA-AA)** is required as amino acids form the largest proportion of the organic N pool

Acknowledgments

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