INTRODUCTION

In response to the increase in anthropogenic CO₂ emissions that are ¹³C-depleted, the carbon isotopic composition (δ¹³C) of atmospheric CO₂ decreased by 0.02 ‰ yr⁻¹; consequently, the δ¹³C values of dissolved inorganic carbon (δ¹³CDIC) in sea water also decreased (the so-called Suess Effect). The North Atlantic ocean is considered as one of the strongest anthropogenic carbon dioxide (CO₂) sink (Fig.1), as a consequence of the large heat loss and deep convection processes during winter, as well as a strong biological activity in summer and fall. In this study, we describe new δ¹³CDIC observations obtained in the Irminger Basin during the OVIDE cruises (2002 and 2006) and we compare them with historical data (TTO-NAŠ 1981) to estimate the oceanic ¹³C Suess Effect and relate this signal with an independent anthropogenic carbon assessment.

DATASET IN THE IRMINGER BASIN

![Fig 2. Pattern of the main a) circulation and b) water masses in the Irminger Basin delimited by their density boundaries (69).](image)

**Fig. 2.**

**Table 1:** Statistics for predictive DIC and δ¹³CDIC estimated by a Multi Linear Regression.

<table>
<thead>
<tr>
<th>δ¹³CDIC</th>
<th>δ¹³CDIC</th>
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<th>δ¹³CDIC</th>
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<tbody>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>0.987</td>
<td>0.982</td>
<td>0.903</td>
<td>0.736</td>
</tr>
<tr>
<td>132</td>
<td>19</td>
<td>276</td>
<td>30</td>
</tr>
</tbody>
</table>

**eMLR equations:**

δ¹³CDIC = (a₀, a₁, a₂) * X + (b₀, b₁, b₂) * X + (c₀, c₁, c₂) * X

**eMLR results:**

δ¹³CDIC = 1000 * (DIC / SHOW - 1)

**ANTHROPOGENIC CARBON CHANGES IN THE IRMINGER BASIN:**

WHAT DO WE LEARN FROM δ¹³CDIC?

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**Figure 1:** Column inventory of anthropogenic CO₂ in the global ocean (Sabine et al., 2004)

**Figure 2:** Pattern of the main a) circulation and b) water masses in the Irminger Basin delimited by their density boundaries (69).

**Figure 3:** Vertical distribution of δ¹³CDIC (‰ vs V-PDB) collected in summer 2002 and 2006 during the OVIDE cruises between the East Greenland Coast (42.5°W) and the Reykjanes Ridge (30°W).

- Maxima δ¹³CDIC in surface waters enhanced by biological activity
- Minima δ¹³CDIC (0.5%o-0.5‰) in the upper 1000m along the Greenland Continental shelf

**Figure 4:** Mean δ¹³CDIC values (‰) versus mean anthropogenic C (µmol kg⁻¹) for each water masses. C was estimated by Perez et al. (2008)

In all water masses we observe a decline in δ¹³CDIC related to anthropogenic CO₂ increase.

**Figure 5:** Vertical distribution of ΔDIC (µmol kg⁻¹) and Δ¹³CDIC (‰) as a function of density (69). ΔDIC (µmol kg⁻¹) and Δ¹³CDIC (‰) are respectively calculated from files 3 - 8 and files 4 - 8 applied either on the TTO dataset (black square) or on the OVIDE 2006 dataset (open square).

**Figure 6:** a) Estimated anthropogenic CO₂ increase (ΔDIC/µmol kg⁻¹ and anthropogenic δ¹³CDIC decrease (Δ¹³CDIC/‰)) in the Irminger Basin (41.5°N-37.5°N) in period from 1981 to 2006. b) DIC/µmol kg⁻¹ and δ¹³CDIC/‰ relationships in the different water masses (Fig 3): EMLR applied on the 2006 dataset. Black contour lines show the Silicate distribution (µmol kg⁻¹); white contour lines symbolize the density boundaries (69).

**Figure 7:** Strong relationship between anthropogenic CO₂ and the ocean ¹³C Suess effect related to the water masses.

This encourage us to investigate further the change in ventilation and export production.

**ACKNOWLEDGMENTS:**

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