

Supporting Information for

**Organic carbon origin, benthic faunal consumption and burial in sediments of northern Atlantic and Arctic fjords (60-81 °N)**

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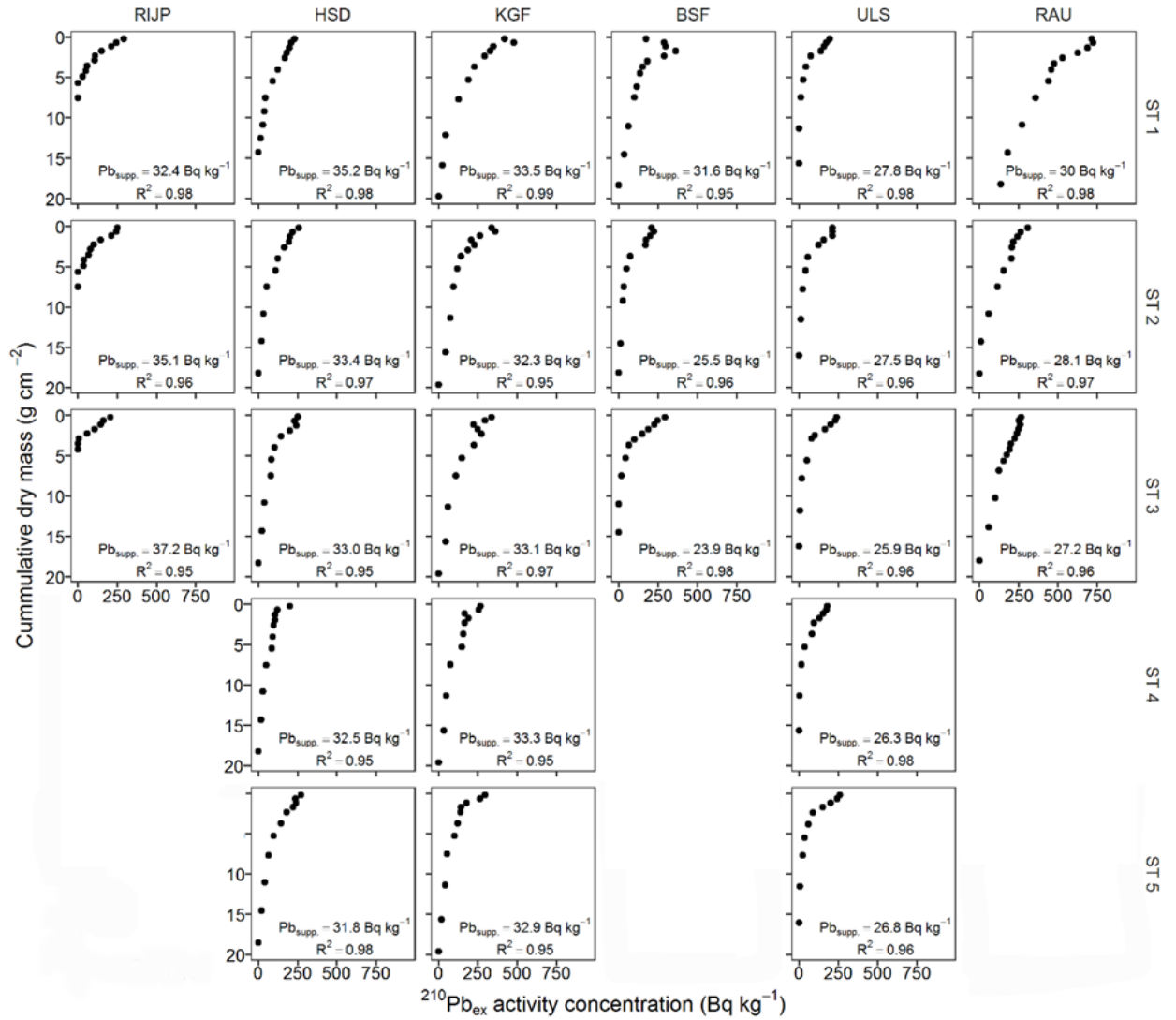
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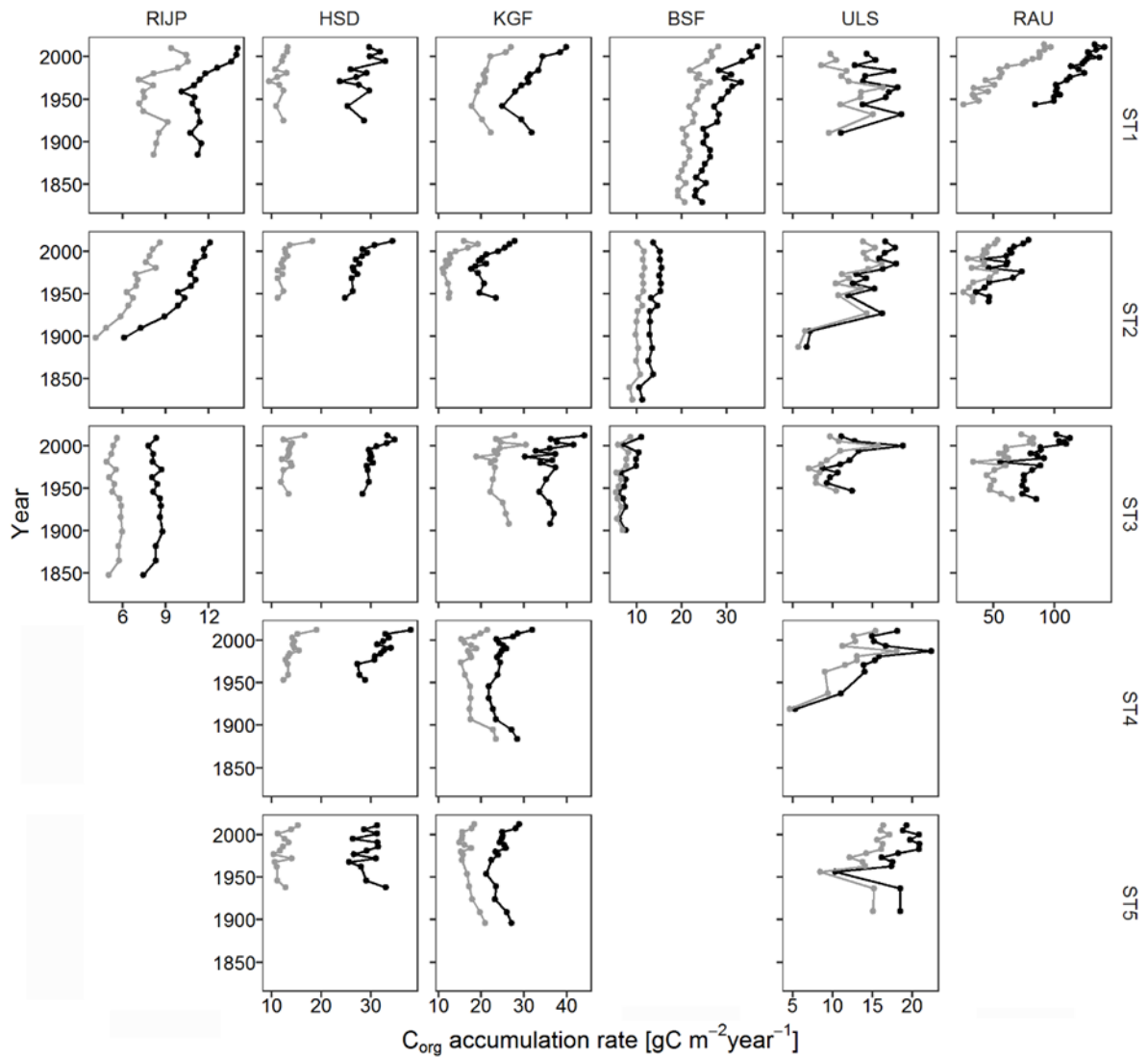
Figures S1 to S2  
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**Introduction**

This supporting information provides figures presenting data plotted for each station separately and tables reporting data for stations, presenting results of statistical analyses and overview of C<sub>org</sub> accumulation data in North Atlantic and Arctic localities from this study and literature.



**Figure S1.** The total  $^{210}Pb_{ex}$  activity concentration [ $Bq\ kg^{-1}$ ] profiles versus cumulative dry sediment mass at stations in fjords. The supported  $^{210}Pb$  ( $^{226}Ra$ ) are given at the graphs together with determination coefficient ( $R^2$ ) of sediment accumulation rate modeling. RIJP-Rijpfjord, HSD- Hornsund, KGF- Kongsfjord, BSF- Balsfjord, ULS-Ullsfjord, RAU-Raunefjord.



**Figure S2.** Organic carbon accumulation rate [ $\text{gC m}^{-2} \text{yr}^{-1}$ ] versus sediment layer deposition year at stations in fjords. Black lines represent total  $C_{\text{org}}$  accumulation rate while grey lines represent accumulation rate of  $C_{\text{org}}$  of marine origin (estimated using two end-members method based on  $\delta^{13}\text{C}$  results). RIJP-Rijpfjord, HSD-Hornsund, KGF-Kongsfjord, BSF-Balsfjord, ULS-Ullsfjord, RAU-Raunefjord.

	mud		C <sub>org</sub>		δ <sup>13</sup> C		chl <i>a</i>		CPE	
	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD
RIJP	0.86	0.09	1.57	0.20	-22.20	0.28	1.28	1.21	7.00	4.61
HSD	0.85	0.03	1.65	0.18	-23.90	0.23	3.37	2.82	16.60	14.80
KGF	0.86	0.09	1.32	0.36	-22.40	0.31	2.24	1.61	14.10	11.30
BSF	0.81	0.08	1.75	0.47	-21.50	0.32	3.67	3.52	16.20	10.40
ULS	0.54	0.10	1.77	0.43	-21.20	0.34	1.34	0.53	6.69	5.77
RAU	0.77	0.09	3.35	0.74	-22.40	0.55	1.68	0.66	18.30	8.69
Permanova main test	PsF=156.01, p=0.001		PsF=140.40, p=0.001		PsF=445.61, p=0.001		PsF=46.63, p=0.01		PsF=43.43, p=0.001	
post-hoc tests, non-significant effects (p>0.05)	RIJP-HSD, RIJP-KGF, HSD-KGF		HSD-BSF, BSF-ULS		KGF-RAU		RIJP-ULS, KGF-RAU		RIJP-ULS, KGF-RAU, HSD-RAU, KGF-BSF	

**Table S1 .** Values of environmental parameters in sediments (0-20 cm): mud [%], organic carbon (C<sub>org</sub> [mg g<sup>-1</sup>]), δ<sup>13</sup>C [‰], chlorophyll *a* (chl *a* [μg g<sup>-1</sup>]) and chloroplastic pigment equivalent (CPE [μg g<sup>-1</sup>]) content. Mean and SD for each fjord are provided, with results of Permanova test for differences among fjords (main and post-hoc tests, only non-significant effects). RIJP-Rijpfjord, HSD-Hornsund, KGF-Kongsfjord, BSF- Balsfjord, ULS-Ullsfjord, RAU-Raunefjord.

		macro	macro Nem	meio	macro	macro Nem	meio	macro	macro Nem	meio
fjord	station	biomass			production			respiration		
RAU	1	443.6	0.011	16.7	665.1	3.2	97.6	1875.0	10.2	350.3
RAU	2	345.6	0.022	19.9	483.3	6.9	117.8	1248.0	22.2	424.1
RAU	3	379.4	0.021	5.7	520.9	6.2	39.7	1293.0	20.0	145.7
BSF	1	291.3	0.000	2.5	280.9	0.0	22.6	559.9	0.0	85.0
BSF	2	763.3	0.025	4.2	564.0	7.1	25.9	1195.5	22.7	93.5
BSF	3	1182.1	0.027	5.5	697.8	6.2	33.3	1653.4	19.1	119.8
ULS	1	188.5	0.023	24.8	196.6	6.8	132.2	419.1	22.0	470.0
ULS	2	269.3	0.012	9.4	306.2	4.8	56.9	632.7	15.9	204.0
ULS	3	122.7	0.013	25.5	154.4	3.3	160.0	325.1	10.5	579.1
HSD	1	1822.5	0.066	53.2	1963.9	13.2	354.6	3300.9	40.8	1283.2
HSD	3	644.0	0.014	46.0	704.1	4.3	257.5	1261.1	14.0	923.7
HSD	5	2048.7	0.112	41.3	2228.8	24.9	216.7	3511.2	77.1	770.8
KGF	1	500.1	0.064	32.7	596.5	23.4	203.3	1368.3	77.3	729.7
KGF	2	773.2	0.016	28.8	1049.2	4.4	212.4	2453.0	14.0	786.7
KGF	3	480.5	0.004	14.9	637.2	1.5	95.2	1420.7	4.8	346.0
RIJP	1	415.8	0.013	19.3	334.1	3.7	95.8	608.8	11.6	342.5
RIJP	2	834.1	0.008	6.3	644.8	2.3	40.9	1133.6	7.4	150.4
RIJP	3	231.2	0.032	31.8	234.0	10.8	238.9	436.8	35.4	889.2

**Table S2** Total macrofauna (macro), macrofaunal Nematoda (macroNem) and meiofauna (meio) biomass [mgC 0.1 m<sup>-2</sup>], production [mgC 0.1 m<sup>-2</sup>yr<sup>-1</sup>] and respiration [mgC 0.1 m<sup>-2</sup>yr<sup>-1</sup>] at each station. RIJP-Rijpfjord, HSD-Hornsund, KGF-Kongsfjord, BSF- Balsfjord, ULS-Ullsfjord, RAU-Raunefjord.

fiord	st	CPE	C <sub>org</sub>	LAR	MAR	range of C <sub>org</sub> AR	C <sub>org</sub> BR	marine C <sub>org</sub> BR	benthic biomass	benthic biomass	benthic CD
		[µg g <sup>-1</sup> ]	[mg g <sup>-1</sup> ]	[cm yr <sup>-1</sup> ]	[g m <sup>-2</sup> yr <sup>-1</sup> ]	[gC m <sup>-2</sup> yr <sup>-1</sup> ]	[gC m <sup>-2</sup> yr <sup>-1</sup> ]	[gC m <sup>-2</sup> yr <sup>-1</sup> ]	[gDM 0.1m <sup>-2</sup> ]	[gC 0.1m <sup>-2</sup> ]	[gC yr <sup>-1</sup> 0.1m <sup>-2</sup> ]
RAU	1	20.94	40.0	0.33	3059	94-133	94	35	1.07	0.46	4.91
RAU	2	18.16	27.2	0.25	2116	43-79	43	33	0.85	0.37	3.74
RAU	3	15.59	32.3	0.26	2686	77-102	77	53	0.87	0.39	3.29
BSF	1	15.96	19.8	0.17	1554	25-37	25	20	0.73	0.29	1.56
BSF	2	21.39	20.1	0.10	690	11-14	11	9	2.29	0.77	3.09
BSF	3	10.39	11.2	0.11	711	7-11	7	6	4.02	1.19	4.12
ULS	1	9.90	20.1	0.10	756	11-14	11	9	0.45	0.21	2
ULS	2	6.47	16.4	0.11	897	7-17	7	6	0.8	0.28	1.97
ULS	3	5.32	14.1	0.11	840	10-11	10	9	0.34	0.15	2
ULS	4	5.17	16.4	0.12	905	8-18	8	7	-		-
ULS	5	6.29	21.0	0.11	878	18-19	18	15	-		-
HSD	1	23.08	18.5	0.17	1536	27-30	27	11	5.1	1.88	2.27
HSD	2	16.68	16.4	0.20	1702	26-34	26	11	-	-	-
HSD	3	15.02	17.3	0.22	1770	29-33	29	12	1.86	0.69	3.24
HSD	4	14.87	14.8	0.23	2164	28-36	28	13	-	-	-
HSD	5	14.34	15.6	0.18	1883	29-31	29	12	5.8	2.09	2.96
KGF	1	21.61	18.4	0.17	1736	31-40	31	21	1.3	0.53	4.77
KGF	2	10.42	8.9	0.24	2461	22-28	22	12	2.02	0.8	7.4
KGF	3	17.55	15.5	0.24	2340	36-44	36	26	1.31	0.5	4.11
KGF	4	10.04	11.5	0.22	2201	24-32	24	19	-	-	-
KGF	5	10.74	12.6	0.20	1958	25-29	25	20	-	-	-
RIJP	1	6.17	17.1	0.13	686	11-14	11	8	1.09	0.44	2.27
RIJP	2	8.85	14.6	0.11	659	7-12	7	4	2.11	0.84	3.24
RIJP	3	6.13	15.4	0.11	582	7-8	7	5	0.66	0.26	2.96

**Table S3.** Mean chloroplastic pigments (CPE), organic carbon content (C<sub>org</sub>), linear sediment accumulation rate (LAR), mass sediment accumulation rate (MAR), range of organic carbon accumulation rate (C<sub>org</sub> AR, variation across sediment layers), organic carbon burial rate (C<sub>org</sub> BR) and total benthic biomass expressed in dry mass [gDM 0.1m<sup>-2</sup>] and organic carbon [gC 0.1m<sup>-2</sup>] units and total benthic organic carbon demand (CD) at each station (st). RIJP-Rijpfjord, HSD-Hornsund, KGF-Kongsfjord, BSF-Balsfjord, ULS-Ullsfjord, RAU-Raunefjord.

location (region) latitude	C <sub>org</sub> [%]	MAR [kg m <sup>-2</sup> yr <sup>-1</sup> ]	C <sub>org</sub> BR [gC m <sup>-2</sup> yr <sup>-1</sup> ]	C <sub>org</sub> AR [gC m <sup>-2</sup> yr <sup>-1</sup> ]	reference
<b>Temperate fjords</b>					
Oslofjord (Norway) 59°N	1.5-6.0	0.3-2.6	6-22*	6-78*	[Dolven <i>et al.</i> , 2013]
Onarheimsfjord (Norway) 60°N	0.7-2.8	0.9-2.7	7-13*	7-42	[Sjetne, 2017]
Lurefjord (Norway) 60°N	11.7-14.5	0.2-0.5	25*	25-72	[Torper, 2017]
Kyllarenfjord (Norway) 61°N	7-10	0.7-0.2	4-5*	4-16	[Smittenberg <i>et al.</i> , 2004]
Drammensfjord (Norway) 59°N	5-25	0.5-1.3	5-10*	5-30	[Smittenberg <i>et al.</i> , 2005]
Drammensfjord (Norway) 59°N	3-5	0.75-0.85	~23*	20-60	[Huguet <i>et al.</i> , 2007]
Nordasvannet (Norway) 60°N	10.7-12.4	0.04-0.16	9-10*	5-20	[Müller, 2001]
Barsnesfjord (Norway) 60°N	2.6-3.5	1.5-3.7	-	53-96	[Paetzel and Schrader, 1992]
Lysefjord and Hogsfjord (Norway) 59°N	1.5-6.8	0.4-4.4	13-40*	13-300	[Duffield <i>et al.</i> , 2017]
Loch Linnhe (Scotland) 56°N	-	4.6	-	146	[Overnell and Young, 1995]
Loch Etive (Scotland) 56°N	0.7-4.0	~6*	-	42-240*	[Loh <i>et al.</i> , 2008] [Al-Qasmi <i>et al.</i> , 2018]
Kaldbaksfjordur (Faroe Islands) 62°N	2.2-2.5	5.4	118*	118-134*	[Norði <i>et al.</i> , 2018]
Saguenay Fjord (Canada) 48°N	1.3-2.4	1.2-12	-	24-292	[St-Onge and Hillaire-Marcel, 2001]
Raunefjord (Norway) 60°N	3.0-4.0	2.1-3.0	43-94	43-133	this study
<b>Sub-Arctic fjords</b>					
Ullsfjord (Norway) 69°N	2.5-2.9	0.3	-	6	[Sauer <i>et al.</i> , 2016]
Ullsfjord (Norway) 69°N	1.4-2.0	0.7-0.9	7-18	7-19	this study
Balsfjord (Norway) 69°N	1.1-1.9	0.7-1.5	7-25	7-37	this study
Malangen (Norway) 69°N	0.6	~1.0	6*	6	[Glud <i>et al.</i> , 1998]
<b>Arctic fjords (non-active glaciers) - no dominant material source</b>					
Rijpfjord (Svalbard) 81°N	1.5-1.7	0.5-0.7	7-11	7-14	this study
Rijpfjord (Svalbard) 81°N	1.0-1.5		4*	4	[Turner, 2014]
Storfjord (Svalbard) 77°N	2.4	1.4	3*	3	[Glud <i>et al.</i> , 1998]
Young Sound (Greenland) 74°N	-	-	-	7.2	[Rysgaard and Nielsen, 2006]
<b>Arctic fjords (active glaciers) - glacial or glaciofluvial inflows</b>					
Kongsfjord (Svalbard) 79°N	0.3-1.3	1.3-3.2	9-13	9-17	[Kuliński <i>et al.</i> , 2014]
Kongsfjord (Svalbard) 79°N	1.3-1.9	1.2-2.0	11-16	6-21	[Koziorowska <i>et al.</i> , 2018]
Kongsfjord (Svalbard) 79°N	0.3-0.6	5.5-6.3	15-16	15-35	[Zaborska <i>et al.</i> , 2018]
Kongsfjord (Svalbard) 79°N	0.9-1.8	1.7-2.5	24-31	24-44	this study
Hornsund (Svalbard) 77°N	0.5-1.8	1.3-2.3	22-33	19-41	[Koziorowska <i>et al.</i> , 2018]
Hornsund (Svalbard) 77°N	0.9-1.6	2.9-3.3	35-39	35-42	[Zaborska <i>et al.</i> , 2018]
Hornsund (Svalbard) 77°N	1.5-1.9	1.5-2.2	26-29	26-36	this study
Hornsund (Svalbard) 77°N	1.5-1.8	1.9-4.7	34-70*	34-70	[Glud <i>et al.</i> , 1998]
Smeerenburgfjord (Svalbard)	0.75-1.4	4.0	-	55*	[Wehrmann <i>et al.</i> , 2014]

79°N					
Van Keulenfjord (Svalbard) 76°N	1.5-1.6	2.9	-	43-46*	[Wehrmann et al., 2014]
Nansen Fjord (Greenland) 68°N	0.5-0.6	1.7-10.1	-	9-50*	[Smith et al., 2002]
Miki Fjord (Greenland) 68°N	0.5-0.8	2.5	-	13-20*	[Smith et al., 2002]
Kangerlussuaq Fjord (Greenland) 68°N	0.1-0.4	4.3	-	4-17*	[Smith et al., 2002]
Van Mijenfjord (Svalbard) 78°N	1.8	1.9	34*	34	[Glud et al., 1998]
<b>Arctic and subarctic shelf seas</b>					
North Bering-Chukchi Sea (off Alaska) 66-73°N	0.1-2.8	0.3-1.6		1-23	[Stein et al., 2004]
Barents Sea 74-80 °N	1.0-2.6	0.3-0.7	3.7-8.5*	3.7-8.5	[Carroll et al., 2008]
Gulf of St. Lawrence (Canada) 48°N	1.2-3.1	0.3	-	5-6	[Silverberg et al., 2000]
Gulf of St. Lawrence(Canada) 48°N	0.6-2.2	-	-	0.7-4.0	[Louchouart et al., 1997]
Gulf of St. Lawrence (Canada) 48°N	0.8-2.5	-	-	0.7-2.5	[Muzuka and Hillaire-Marcel, 1999]
SW Iceland Shelf 64°N	1.3-1.8	1.4	18.2*	18.2-22.2*	[Smith et al., 2002]
E Greenland Shelf 67°N	1.3-1.8	0.9	11.7*	11.7-16.2*	[Smith et al., 2002]
Labrador Sea 55-60°N	0.1-1.8	-	-	0.1-1.5	[Muzuka and Hillaire-Marcel, 1999]

**Table S4.** Organic carbon content ( $C_{org}$ ) mass sediment accumulation rates (MAR), organic carbon accumulation ( $C_{org}AR$ ) and burial rates ( $C_{org}BR$ ) in North Atlantic and Arctic fjords and shelf sediments based on this study and literature data.  $C_{org}BR$  estimates are based on  $C_{org}$  content in the deepest later (around or below 20cm depth). \* indicates that  $C_{org}AR$  or  $C_{org}BR$  was calculated using MAR and  $C_{org}$  concentration data available in the cited paper. Literature data include data on sediments deposited within last century and dated by  $^{210}Pb$  method (as in the present study).