



HAL
open science

Diatom valve distribution and sedimentary fatty acid composition in Larsen Bay, Eastern Antarctica Peninsula

E. Sañé, E. Isla, Audrey M Pruski, M. A. Bárcena, G. Vétion, D. J. Demaster

► To cite this version:

E. Sañé, E. Isla, Audrey M Pruski, M. A. Bárcena, G. Vétion, et al.. Diatom valve distribution and sedimentary fatty acid composition in Larsen Bay, Eastern Antarctica Peninsula. *Continental Shelf Research*, 2011, 31 (11), pp.1161-1168. 10.1016/j.csr.2011.04.002 . hal-02908657

HAL Id: hal-02908657

<https://hal.sorbonne-universite.fr/hal-02908657>

Submitted on 29 Jul 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Author's Accepted Manuscript

Diatom valve distribution and sedimentary fatty acid composition in the Larsen A and B bays, Eastern Antarctica Peninsula

E. Sañé, E. Isla, A.M. Pruski, M.A. Bárcena, G. Vétion, D. DeMaster

PII: S0278-4343(11)00129-4
DOI: doi:10.1016/j.csr.2011.04.002
Reference: CSR2360

To appear in: *Continental Shelf Research*

Received date: 18 March 2010
Revised date: 10 March 2011
Accepted date: 5 April 2011

Cite this article as: E. Sañé, E. Isla, A.M. Pruski, M.A. Bárcena, G. Vétion and D. DeMaster, Diatom valve distribution and sedimentary fatty acid composition in the Larsen A and B bays, Eastern Antarctica Peninsula, *Continental Shelf Research*, doi:10.1016/j.csr.2011.04.002

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



www.elsevier.com/locate/csr

Diatom valve distribution and sedimentary fatty acid composition in the Larsen A and B bays, Eastern Antarctica Peninsula.

¹Sañé, E., ¹Isla, E., ^{2,3}Pruski, A.M., ⁴Bárcena, M.A., ^{2,3}Vétion, G., ⁵DeMaster, D.

¹Institut de Ciències del Mar-CSIC, Passeig Marítim de la Barceloneta 37-49, Barcelona E-08039, Spain

²UPMC Univ Paris 06, FRE 3350, LECOB, Observatoire Océanologique, F-66651 Banyuls/mer, France

³CNRS, FRE 3350, LECOB, Observatoire Océanologique, F-66651, Banyuls/mer, France

³Depto. de Geología y Paleontología, Facultad de Ciencias, Universidad de Salamanca 37008 Salamanca, Spain

⁵Department of Marine, Earth and Atmospheric Sciences, North Carolina State University, Raleigh, NC 27695-8208, U.S.A.

Abstract

During austral summer 2006-2007, five sediment cores were recovered from the Eastern Antarctic Peninsula (EAP) continental shelf. Microscopic observations and sediment fatty acid (FA) composition analyses were carried out to investigate whether the drastic changes at the sea surface in EAP may be reflected in the sedimentary record. A sharp decrease in the number of diatom valves was observed below 2 cm depth. This evident difference between the upper 2 cm of sediment and the deeper part of the sediment column was attributed to the drastic change in the upper water column conditions after the ice shelf collapses, which allowed the arrival of phytoplankton debris and fresh organic matter to the seafloor in EAP. The presence of bacterial-, zooplankton- and detrital-related FA throughout EAP cores suggests that there has been an input of older, more refractory organic matter into the region, presumably by lateral transport, before Larsen ice shelves disintegration.

1. Introduction

In the last 60 years atmospheric and oceanic temperatures have risen (Vaughan et al., 2001; Gille, 2002), leading to an increase of glacier retreat in the Antarctic Peninsula (Cook et al., 2005). In 1995, 4200 Km² of the Larsen A ice shelf collapsed, whereas 3200 Km² of the Larsen B ice shelf disintegrated in 33 days in 2002 (Rott et al., 1996; Domack et al., 2005). These events drastically modified the local conditions at the sea surface, relatively constant for hundreds of years (Domack et al., 2005). The ice shelf collapses enabled primary production in the recently open space (Bertolin and Schloss, 2009) to develop a flux of fresh organic debris to the seabed. Thus, studying the sediments organic matter (OM) content beneath extinct ice shelves may reveal how changes at the euphotic zone impact the benthic realm.

Sediment microscopic observations of phytoplankton provide information about the origin of the OM present in the sediment (Reuss and Poulsen, 2002). Diatoms, radiolaria, siliceous sponges, and silicoflagellates contribute with their siliceous skeleton to the biogenic silica flux to the seafloor and the consequent accumulation of this biogenic constituent in the sediment column (Abelmann and Gersonde, 1991; DeMaster, 2002). Diatom valves and sponge spicules represent the principal sources of biogenic silica in sediments (Rützler and MacIntyre, 1978; Bavestrello et al., 1996) and, in the Southern Ocean, diatoms represent 40% of the total primary production (Cortese and Gersonde, 2007), with high biomasses in Antarctic coastal regions (Wright and van den Enden, 2000; Arrigo et al., 2008; Beans et al., 2008). In the water

48 column, diatom valves are subjected to grazing (Crosta, 2009), advection and
49 dissolution (Buffen et al., 2007), nevertheless their frustules are well-preserved in
50 sediments (Tsoy et al., 2009). *Fragilariopsis kerguelensis* is the most abundant diatom
51 species in Antarctic surface sediments (Cortese and Gersonde, 2007) and in this study
52 has been considered as an indicator of open-water conditions (Crosta et al., 2005;
53 Roberts et al., 2007). The diatom valves of sea-ice related taxa (*Fragilariopsis curta*, *F.*
54 *cylindrus*, *F. obliquecostata* and *F. sublinearis*), auxospores of *Thalassiosira antarctica*,
55 as well as the resting spores (RS) of genus *Chaetoceros* have been treated as sea-ice
56 related species (Armand et al., 2005). These sea-ice related taxa are present within the
57 Sea Ice Zone southward of the Polar Front, living within, on or under the sea ice
58 (Armand et al., 2005). *Thalassiosira antarctica* is a sea-ice related species (Garrison et
59 al., 1987; Garrison, 1991) indicative of seasonally varying sea-ice conditions, which
60 shows maximum abundance near the ice shelf edge, but requires cold open water to
61 dwell (Pike et al., 2008) and *Chaetoceros* RS abundance reflects episodes of high
62 primary production (Donegan and Schrader, 1982; Leventer, 1991; Sancetta et al.,
63 1992; Karpuz and Jansen, 1992).

64 Fatty acids (FA), aliphatic hydrocarbon chains with a carboxylic group at one extremity,
65 are synthesised in the cytosol. In marine organisms FA are predominantly found in
66 energetic reserves which consist of triacylglycerols and wax esters, as well as in the
67 phospholipids of the membrane lipid bilayer (Ding and Sun, 2005). A partial and
68 selective degradation of FA occurs in the water column and in the sediment (Sun et al.,
69 1997; Wakeham et al., 1997) and is particularly intense at the sediment-water interface
70 (Laureillard et al., 1997). However, FA occurrence in the sediment column has been
71 broadly studied (Farrington and Quinn, 1973; Perry et al., 1979; Volkman et al., 1980;
72 Venkatesan, 1988; Canuel and Martens, 1996; Sun and Wakeham, 1994; Cripps and
73 Clarke, 1998). The presence of FA in Antarctic sediments has been ascribed to marine
74 primary and secondary production due to the absence of terrestrial inputs (Venkatesan
75 and Kaplan, 1987; Cripps, 1995; Cripps and Clarke, 1998). Diatoms, dinoflagellates,
76 bacteria and zooplankton organisms are characterized by different FA and through
77 their signature is possible to obtain information about the potential sources of the
78 sedimentary organic matter found in the sea floor (Budge and Parrish, 1998; Camacho-
79 Ibar et al., 2003). The specificity of FA for particular organisms together with the
80 different labilities of FA depending on their chemical structure (Haddad et al., 1992;
81 Canuel and Martens, 1996; Sun and Wakeham, 1994; Camacho-Ibar et al., 2003; Lü et
82 al., 2010), make FA analysis a useful tool to investigate on OM sources and quality.

83 Microscopic counts of diatom valves and sediment FA composition analysis have been
84 carried out in the sedimentary record to verify the presence of temporal changes in the
85 FA and diatom valve signatures related to Larsen A and B ice shelves collapse.

86

87 **2. Methods**

88 *2.1 Sediment collection and preparation*

89 Sediment samples were collected during the Antarctic expedition ANT-XXIII/8 off the
90 Eastern coast of the Antarctic Peninsula (EAP) (Fig. 1) using a multi-corer with
91 polycarbonate core barrels of 10 cm of diameter (Barnett et al., 1984). Sediments were
92 sampled at 5 stations, namely Larsen B South (LBS), Larsen B West (LBW), Larsen B
93 Central (LBC), Larsen B North (LBN) and Larsen A (LA) (Fig.1). After recovery,
94 sediment cores were sliced onboard in slices 0.5 cm thick from 0 to 9 cm depth. LA
95 core was only 7.5 cm long. Subsamples were immediately frozen at -20°C. Sediment
96 samples were freeze-dried (P=0.1 mbar and T=-80°C) for 24 hours before laboratory
97 analyses and microscopic observations.

98

99 *2.2 Diatom slides preparation and microscopic observation*

100 Sediment samples were prepared according to the standard randomly distributed
101 microfossils method. Due to the high abundance of diatom valves, it was not necessary
102 to disaggregate sediment with sodium pyrophosphate. Hydrochloric acid (HCl) and
103 hydrogen peroxide (H₂O₂) were added to a known weight of dry sediment to attack
104 carbonates and OM. Sediment was rinsed several times with bi-distilled water, slides
105 were mounted and diatom valve counts were performed at 1000 magnification using a
106 Leica DMLB with phase-contrast illumination. Counts were carried out on permanent
107 slides of acid-cleaned material (Permount mounting medium). Schrader and Gersonde
108 (1978) recommendations were followed for the counting of microfossil valves.
109 Depending on diatoms abundance, several traverses across each cover slip were
110 examined. A minimum of 350 valves were counted for each sample, when possible.
111 Moreover, a counting of at least 100 valves of non-dominant taxa per sample was
112 performed. Valves of sea-ice taxa and *F. kerguelensis*, auxospores of *T. antarctica*
113 were identified together with *Chaetoceros* RS.

114 Diatom valve inventories were calculated by summing the product of the number of
115 diatom valves, the depth interval (slice thickness) and the wet bulk density of each sub
116 sample. Inventories are expressed in number of diatom valves per square centimeter
117 (valves cm⁻²). Diatom valve fluxes were calculated from diatom valve inventories and
118 expressed in number of diatom valves per square centimeter per year (valves cm⁻² yr⁻¹).
119 Fluxes were calculated by dividing diatom valve inventories by the number of years

120 of deposition, assuming no differences in the flux of diatoms to the seabed among
121 years.

122

123 *2.3 Fatty acid extraction*

124 Fatty acids were extracted through a one step transesterification process adapted from
125 Lewis et al., (2000) and Indarti et al. (2005) according to the recommendations of
126 Christie (2003). The analytical protocol is detailed in Nahon et al (2010). Approximately
127 2 g of dried sediment were extracted in 8 ml of a cold solution of methanol, 98%
128 sulphuric acid and chloroform in the presence of butyl hydroxytoluene (BHT), an
129 antioxidant at a concentration of 50 mg l⁻¹ (Christie, 2003) The ratio of methanol to
130 chloroform to sulphuric acid in the solvent extraction was 1.7:2:0.3 v/v/v. 20 µl of the
131 internal standard C19:0 (nonadecanoic acid) (1mg ml⁻¹) were added and the samples
132 were placed in a preheated oven at 90°C for 90 minutes. With this procedure lipids
133 were extracted and the released fatty acids were directly methylated in fatty acid
134 methyl esters (FAME). Ultra pure water (2 ml) was added to each sample to partition
135 the extract in two phases. Following centrifugation (5 minutes at 1500 rpm and 4°C),
136 the inferior chloroform phase was recovered. A second extraction was made with a
137 solution of hexane and chloroform (4:1 v/v) and, after centrifugation (5 minutes at 1500
138 rpm and 4°C), the superior phase was recovered and added to the first organic phase.
139 This procedure was repeated twice. The organic phases were pooled and cleaned with
140 a cold solution of potassium carbonate (2%) and after centrifugation (5 minutes at 1500
141 rpm and 4°C) 6 to 9 ml of the organic phase were recovered and an aliquot was
142 evaporated to dryness in a rotary evaporator (Savant Speed Vac system) at room
143 temperature. FAME were recovered in 75 µl of pure hexane prior to analysis. Fatty
144 acids as methyl esters were analysed using a Varian 3900 gas chromatograph (GC)
145 coupled to a Saturn 2100T ion-trap mass spectrometer (MS). A Varian Factor Four
146 capillary column WAX-ms was used. The column had a length of 30 m and an internal
147 diameter of 0.25 mm; film thickness was 0.25 µm. The flow was constant with a velocity
148 of 1 ml/min. The column oven stabilization time was 0.30 min, the injector temperature
149 was 260°C and the volume injected was 1 µl. The use of known standards as
150 reference (Supelco 37, PUFA n°1 and n°3) allowed the identification of 22 individual
151 fatty acids.

152

153 In order to present the dataset in a comprehensible form, fatty acids were grouped
154 according to their chemical structure in:

155 (1) Polyunsaturated fatty acids (PUFA): compounds with two or more unsaturated
156 bonds.

- 157 (2) Monounsaturated fatty acids (MUFA): compounds with one unsaturation.
158 (3) Mid chain fatty acids (MC-FA): chain length $\leq C_{20}$.
159 (4) Long chain fatty acids (LC-FA): chain length $C_{21}-C_{26}$.

160

161 3. Results

162

163 3.1 Microscopic observation of diatom valves

164 The total abundance of diatom valves in the upper 0.5 cm of sediment ranged from
165 $\sim 1.3 \times 10^6$ valves g^{-1} (station LBS) to $\sim 18.4 \times 10^6$ valves g^{-1} (station LBC) (Fig. 2). Diatom
166 valve abundances decreased with depth and, in the four Larsen B cores, they were
167 negligible below 2 cm depth (Fig. 2).

168 Diatom valve inventories varied between $\sim 4.7 \times 10^6$ valves cm^{-2} (station LBW) and ~ 35.3
169 $\times 10^6$ valves cm^{-2} (station LBC), whereas diatom valve fluxes varied between $\sim 9.4 \times 10^5$
170 valves $cm^{-2} yr^{-1}$ (station LBW) and $\sim 70.5 \times 10^5$ valves $cm^{-2} yr^{-1}$ (station LBC) (Table 1).

171 As regards diatoms composition, valves of sea-ice taxa, auxospores of *T. antarctica*
172 and *Chaetoceros* RS were found in all stations. Mean relative abundances of sea-ice
173 taxa and *Chaetoceros* RS in the upper 0.5 cm of sediment of the five EAP cores were
174 $\sim 40\%$ and $\sim 52\%$, respectively, and decreased with depth (Fig. 3). The mean relative
175 abundance of the auxospores of *T. antarctica* was $\sim 1\%$ and didn't change with depth
176 (Fig. 3).

177

178 3.2 Fatty acid composition

179 Diatom indicators 14:0 and 16:1(n-7) (Nichols et al., 1986; Nichols et al., 1993;
180 Dunstan et al., 1994) were present in all the stations (Fig. 4). In the superficial
181 sediment (upper 0.5 cm), the concentration of FA 14:0 varied between $\sim 4 \mu g g^{-1}$ (LBA)
182 and $\sim 8 \mu g g^{-1}$ (LBS), whereas that of FA 16:1(n-7) varied between $\sim 3 \mu g g^{-1}$ (LBA) and
183 $\sim 9 \mu g g^{-1}$ (LBC). A decrease in the concentration of diatom indicators with depth was
184 evident in cores LBS, LBC and LBN (Fig. 4). Dinoflagellate indicators 16:0 and 18:1(n-
185 9) cis (Dalsgaard et al., 2003; Søreide et al., 2008) and zooplankton indicators 20:1(n-
186 9) and 22:1(n-9) (Falk-Petersen et al., 1999) were present at the five stations (Fig. 4).
187 The superficial concentration of dinoflagellate indicator FA 16:0 varied between $\sim 23 \mu g$
188 g^{-1} (LBA) and $\sim 42 \mu g g^{-1}$ (LBN), whereas that of dinoflagellate indicator FA 18:1(n-9) cis
189 varied between $\sim 18 \mu g g^{-1}$ (LBA) and $\sim 52 \mu g g^{-1}$ (LBC). As regards zooplankton
190 indicators, the superficial concentration of 20:1(n-9) varied between $\sim 2 \mu g g^{-1}$ (LBA)
191 and $\sim 4 \mu g g^{-1}$ (LBC and LBN), and that of FA 22:1(n-9) between $\sim 3 \mu g g^{-1}$ (LBA) and ~ 6
192 $\mu g g^{-1}$ (LBS). Odd bacterial FA 11:0, 13:0 and 15:0 (Lee, 1992; Dalsgaard et al., 2003
193 and references therein) were present in all the stations (Fig. 4). In the superficial

194 sediment, the concentration of FA 11:0 was $\sim 0.1\text{-}0.2 \mu\text{g g}^{-1}$, that of FA 13:0 was $\sim 0.2\text{-}$
195 $0.4 \mu\text{g g}^{-1}$ and that of FA 15:0 was $\sim 0.6\text{-}1.1 \mu\text{g g}^{-1}$.

196 PUFA represented a small component of the total FA pool. Only one PUFA was
197 present at the five stations, 18:2(n-6) cis. The concentration of 18:2(n-6) cis in the
198 superficial sediment varied between $\sim 1 \mu\text{g g}^{-1}$ (LA) and $\sim 2 \mu\text{g g}^{-1}$ (LBC) (Fig. 5). Four
199 MUFA, namely 16:1(n-7), 18:1(n-9)cis, 20:1(n-9) and 22:1(n-9), were found in the five
200 stations, whereas 24:1(n-9) only occurred at LBS. The total concentration of MUFA in
201 the superficial sediment varied between $\sim 26 \mu\text{g g}^{-1}$ (LA) $\sim 70 \mu\text{g g}^{-1}$ (LBC) (Fig. 5). MC-
202 FA 8:0, 10:0, 11:0, 12:0, 13:0, 14:0, 15:0, 16:0, 18:0 and 20:0 were present in the five
203 cores. In the superficial sediment, the total concentration of MC-FA varied between ~ 68
204 $\mu\text{g g}^{-1}$ (LA) $\sim 101 \mu\text{g g}^{-1}$ (LBW) (Fig. 5). Among the LC-FA, 22:0 and 24:0 were the only
205 compounds present at the five stations. 21:0 only occurred at LBS and LBN and 26:0 at
206 LBS. The total concentration of LC-FA in the superficial sediment varied between ~ 0.5
207 $\mu\text{g g}^{-1}$ (LA) and $\sim 1.4 \mu\text{g g}^{-1}$ (LBC) (Fig. 5).

208

209 4. Discussion

210 FA and diatom valves were assessed in the continental shelf of EAP to find whether
211 these indicators can reflect changes in the sediment column derived from the presence
212 and recent disintegration of the Larsen A and B ice shelves.

213 Radionuclides (^{210}Pb and ^{14}C) data were used to establish sediment chronologies and
214 determine which layer in the EAP sediment column could correspond to the time when
215 Larsen ice shelf collapses occurred (Isla et al., unpublished results). Sediment cores
216 were obtained only a decade after Larsen A and B ice shelf collapsed and, given the
217 ^{210}Pb half life (22.3 y), steady state conditions were not yet attained in this region. The
218 analysis of ^{14}C in sediment core LBW showed that the SAR was on the order of 0.04
219 cm y^{-1} (Isla et al., unpublished results). This low sedimentation rate suggested that in
220 EAP, accumulation (advection) is still negligible and diffusion is the main responsible
221 for particle motion in the sediment cores of this region. The rather low sediment
222 accumulation in EAP led us to argue that the layer which corresponds to the time
223 period after the ice shelf collapses in Larsen A and Larsen B is, at most, only few
224 millimetres thick. These low accumulation rates hamper distinguishing differences
225 between Larsen A and B profiles (Fig. 2, 4 and 5), despite the 7-year difference in the
226 respective ice shelf collapses in the two bays. The significant correlation between the
227 excess ^{210}Pb activity, diatom valves abundance and pigment concentration profiles
228 (Fig. 6, see also Sañé et al., 2011) provided evidence to suggest that pigments and
229 diatom valves were deposited in EAP only after the ice shelves collapsed and primary
230 production started developing (Bertolin and Schloss, 2009; Isla et al., unpublished

231 results). Then, the biogenic material from the upper millimetres has been redistributed
232 along the upper 2 cm layer during the last decade (Fig. 6) and we assume that all the
233 organic matter present below 2 cm depth reached EAP region though lateral transport
234 before the collapse of Larsen ice shelves.

235 Based on the fact that primary production started in the Larsen bays only ~10 years
236 ago, after ice shelves collapsed (Bertolin and Schloss, 2009), we hypothesized that
237 higher diatom valve abundances and FA concentrations should be found at the top of
238 the sediment cores than below 2 cm depth. Furthermore, we also hypothesised that
239 differences in FA concentrations related to organic matter lability would be found
240 between the upper 2 cm of sediment (more labile), where the biogenic matter
241 deposited after ice shelf collapses (Isla et al., unpublished results; Sañé et al., 2011)
242 and the deeper part of the sediment cores (more refractory).

243

244 *4.1 Diatom signature*

245 Our results on diatom valves abundance (Fig. 2) confirm that primary production and
246 the vertical flux of organic matter to the sea floor are negligible under ice shelves
247 (Littlepage and Pearse, 1962) and that diatom valve abundances augmented after
248 Larsen ice shelf collapses (Buffen et al., 2007). Furthermore, the absence of diatom
249 valves below the upper 2 cm layer in EAP sediment suggests that the lateral transport
250 of diatom valves into the region is negligible. The diatom valves present in the upper 2
251 cm of sediment have been recently produced and vertically transported through the
252 water column. Given the relatively short period of accumulation of diatom valves in
253 EAP it is rather unlikely that diatom valves in EAP had undergone vigorous dissolution
254 up to the degree that they are not visible towards the base of the core. Thus, valve
255 profiles corroborate that diatoms arrived to EAP sea floor only after Larsen A and B ice
256 shelf collapses.

257 No significant differences in diatom valve fluxes were found between EAP region and
258 two stations off the Northern Antarctic Peninsula which have not been covered by ice
259 shelf for at least 1 kyr (Ingólfsson et al., 1998). In the case of Larsen B cores, diatom
260 valve fluxes were calculated dividing diatom valve inventories from 0 to 5 cm depth by
261 5 years, which is the time span between the ice shelf collapse and the sampling
262 expedition. Based on the excess ^{210}Pb activity and the pigment profiles (Fig. 6 and
263 Sañé et al., 2011), diatom fluxes for EAP were calculated using diatom valve
264 inventories from 0 to 5 cm depth to assure including diatom valves deposited after the
265 ice shelf collapse. In the case of the two stations off the Northern Antarctic Peninsula,
266 the diatom valves inventory of the 11 cm long sediment core corresponding to the
267 Elephant Island station was divided by 36 years (based on a sediment accumulation

268 rate of 3.02 mm y^{-1} ; Isla et al., unpublished results), whereas the diatom valves
269 inventory of the 11 cm long sediment core corresponding to the South Shetland Island
270 station was divided by 58 years (based on a sediment accumulation rate of 1.90 mm y^{-1} ;
271 Isla et al., unpublished results). The presence of icebergs in EAP region, related to
272 the recent Larsen A and B ice shelf collapses, should reduce the available area for
273 phytoplankton blooms to develop, and, consequently, primary production in this region
274 (Arrigo et al., 2002; Arrigo and van Dijken, 2003). Nevertheless, similarities in diatom
275 valve fluxes between EAP region and the two stations off the Northern Antarctic
276 Peninsula may be related to the rather moderate to low primary production off the
277 South Shetland and Elephant Islands (Bodungen et al., 1986; Holm-Hansen and
278 Mitchell, 1991; Holm-Hansen et al., 1997).
279 The absence of *Fragilariopsis kerguelensis* in EAP is consistent with the absence of
280 open water conditions (Crosta et al., 2005) until 1995 and 2002 in Larsen A and B,
281 respectively, whereas the high percentage of sea-ice related taxa implies that this
282 region is not experiencing true seasonal open-water conditions yet (Fig. 3).

283

284 4.2 Fatty acid signature

285 Changes in the FA profiles between the parts of the sediment column corresponding to
286 the pre- and the post- ice shelves collapse were less evident than those observed for
287 the diatom valves signature (Fig. 4, 5), probably due to FA lability. FA are characterized
288 by different labilities depending on their chemical structure. FA with a high number of
289 unsaturations or polyunsaturated FA (PUFA) represent the most labile group of FA
290 (Haddad et al., 1992; Sun and Wakeham, 1994). The low concentration of PUFA (Fig.
291 5) and the absence of PUFA diatom indicators, such as 16:2(n-4) and 16:3(n-4)
292 (Volkman et al., 1989; Wakeham, 1995), even in the upper 2 cm of the sediment
293 column where high abundances of diatom valves were found, suggests that PUFA
294 were previously degraded in the water column or/and after deposition onto the seabed
295 (Smith et al., 1983; Wakeham et al., 1997; Budge and Parrish, 1998; Grossi et al.,
296 2003; Hu et al., 2006). Differently from PUFA diatom indicators, MUFA and MC-FA
297 diatom indicators, like FA 16:1(n-7) and FA 14:0, were found in EAP and their
298 concentrations decreased with depth in the five cores (Fig. 4), reflecting changes in the
299 water column related to Larsen ice shelves disintegration. Differences between FA
300 profiles may be related to the lower lability of MUFA and MC-FA in relation to PUFA
301 (Haddad et al., 1992). The low concentration of FA 14:0 and FA 16:1(n-7) below 2 cm
302 depth (Fig. 4) suggested that these fatty acids which originate from diatoms did not
303 accumulate in EAP sediment column by lateral transport before the collapse of Larsen
304 ice shelves.

305 On the contrary, no temporal changes were observed in the profiles of dinoflagellate
306 indicators MUFA 18:1(n-9) cis and MC-FA 16:0, and in the profiles of zooplankton
307 indicators, MUFA 20:1(n-9) and 22:1(n-9) (Fig. 4). MUFA 18:1(n-9) cis has not only
308 been associated to flagellate-derived material (Søreide et al., 2008), but also to detrital
309 material (Fahl and Kattner, 1993). Its presence throughout EAP cores, like the
310 presence of zooplankton indicators MUFA 20:1(n-9) and 22:1(n-9), could suggest the
311 input of older more refractory OM into the region presumably by lateral transport before
312 ice shelves collapses. Dinoflagellate indicators FA 18:1(n-9) cis and FA 16:0 and
313 zooplankton indicators FA 20:1(n-9) and FA 22:1(n-9) have similar labilities to diatom
314 indicators FA 14:0 and FA 16:1(n-7). Therefore, the low concentration of FA 14:0 and
315 FA 16:1(n-7) below 2 cm depth (Fig. 4) is independent from the lability of these two
316 fatty acids and suggested that they did not reach Larsen region before ice shelf
317 collapses through lateral transport.

318 The absence of bacterial indicators like hydroxylated FA and 18:1(n-7) (Perry et al,
319 1979) or like *iso*- and *anteiso*-FA (Parkers and Taylor, 1983; Kaneda, 1991) suggests a
320 low bacterial activity; the only bacterial indicators present in EAP, MC-FA with an odd
321 number of carbon atoms (Lee, 1992; Dalsgaard et al., 2003 and references therein),
322 may also have accumulated in this region before ice shelf collapses by lateral
323 transport. The idea that MUFA and MC-FA could have been laterally transported to
324 EAP is supported by previous studies on benthos under ice shelves. Even if primary
325 production below ice shelves is negligible (Littlepage and Pearse, 1962), the few
326 studies on benthos below ice shelves revealed that a lateral flux of organic matter
327 maintained benthic assemblages of suspension feeders at different distances from the
328 ice shelf edge (Dayton and Oliver, 1977; Lipps et al., 1979; Riddle et al., 2007).

329 Long-chain saturated FA, LC-FA, are mainly of terrestrial origin and usually considered
330 more resistant to degradation than planktonic FA (Canuel and Martens, 1996;
331 Camacho-Ibar et al., 2003). Due to their low lability (Haddad et al., 1992; Sun and
332 Wakeham, 1994), we expected to find evidence of the lateral transport in the study
333 area of this group of FA. Terrestrial inputs are absent in the study area, therefore,
334 in spite of their low lability, only a low concentration of LC-FA was found in our
335 sediment samples (Fig. 5) and the LC-FA found in EAP may be the result of MUFA
336 chain lengthening (Nichols et al., 1986).

337

338 **4.3 Summary**

339 Diatom valve abundance in sediment cores collected from the continental shelf of the
340 Larsen A and B bays provided evidence to suggest that diatom valves were deposited
341 only after Larsen ice shelves collapse. Temporal changes in the FA signature were less

342 evident than those observed for the diatom valves signature. In spite of the presence of
343 diatom valves in the upper 2 cm of sediment, some diatom indicators like unsaturated
344 FA 16:2(n-4) and 16:3(n-4) were not found in EAP cores, probably due to their high
345 lability. The presence of some bacterial- and zooplankton- related MUFA and MC-FA
346 suggests that there has been an input of refractory organic matter into the region,
347 presumably by lateral transport, before Larsen ice shelves collapse.

348

349 5. References

350

351 Abelmann, A., and Gersonde, R., 1991, Biosiliceous particle flux in the Southern Ocean: Marine
352 Chemistry 35, 503-536.

353 Arrigo, K.R., van Dijken, G.L., Ainley, D.G., Fahnestock, M.A., Markus, T., 2002. Ecological
354 impact of a large Antarctic iceberg. *Geophys. Res. Lett.* 29, 1-4.

355 Arrigo, K.R. and van Dijken, G.L., 2003. Impact of iceberg C-19 on Ross Sea primary
356 production. *Geophys. Res. Lett.* 30, 1-4.

357 Arrigo, K.R., van Dijken, G.L., Bushinsky, E., 2008. Primary production in the Southern Ocean,
358 1997–2006. *Journal of Geophysical Research* 113, C08004.

359 Armand, L., Crosta, X., Romero, O., Pichon, J.J., 2005. The biogeography of major diatom taxa
360 in Southern Ocean sediments. 1. Sea ice related species. *Palaeogeography, Palaeoclimatology,*
361 *Palaeoecology* 223, 93-126.

362 Barnett, P.R.O., Watson, J., Connelly, D., 1984. A multiple corer for taking virtually undisturbed
363 samples from shelf, bathyal and abyssal sediments. *Oceanol. Acta* 7, 399-408.

364
365
366 Bavestrello, G., Cattaneo-Viotti, R., Cerrano, C., Cerutti, S., Sará, M., 1996. Contribution of
367 Sponge Spicules to the Composition of Biogenic Silica in the Ligurian Sea. *Mar. Ecol.* 17, 41-50.

368
369 Beans, C., Hecq, J.H., Koubbi, P., Vallet, C., Wright, S., Goffart, A., 2008. A study of the diatom-
370 dominated microplankton summer assemblages in coastal waters from Terre Adélie to the Mertz
371 Glacier, East Antarctica (1391E–1451E). *Polar Biol.* 31, 1101-1117.

372
373 Bertolin, M.L. and Schloss, I.R., 2009. Phytoplankton production after the collapse of the Larsen
374 A Ice Shelf, Antarctica. *Polar Biol.* 32, 1435-1446.

375
376 Bodungen, B.V., Smetacek, V.S., Tilzer, M.M., Zeitzschel, B., 1986. Primary production and
377 sedimentation during spring in the Antarctic Peninsula region. *Deep-Sea Res.* 33, 177-194.

378
379 Budge, S.M. and Parrish, C.C., 1998. Lipid biogeochemistry of plankton, settling matter and
380 sediments in Trinity Bay, Newfoundland. II. Fatty acids. *Org. Geochem.* 29, 1547–1559.

381
382 Buffen, A., Leventer, A., Rubin, A., Hutchins, T., 2007. Diatom assemblages in surface
383 sediments of the northwestern Weddell Sea, Antarctic Peninsula. *Mar. Micropal.* 62, 7-30.

384
385 Camacho-Ibar, V.F., Aveytua-Alcázar, L., Carriquiry, J.D., 2003. Fatty acid reactivities in
386 sediment cores from the northern Gulf of California. *Organic Geochemistry* 34, 425-439.

387
388 Canuel, E.A. and Martens, C.S., 1996. Reactivity of recently deposited organic matter:
389 degradation of lipid compounds near the sediment-water interface. *Geochim. Cosmochim. Acta*
390 60, 1793-1806.

391

392 Christie, W.W. *Lipid Analysis: Isolation, Separation, Identification and Structural Analysis of*
393 *Lipids*, 3rd Oily Press, Bridgwater, UK (2003) 207 pp.

394

- 395 Cook, A.J., Fox, A.J., Vaughan, D.G., Ferrigno, J.G., 2005. Retreating Glacier Fronts on the
396 Antarctic Peninsula over the Past Half-Century. *Science* 308, 541-544.
397
- 398 Cortese, G. and Gersonde, R. 2007. Morphometric variability in the diatom *Fragilariopsis*
399 *kerguelensis*: implications for Southern Ocean paleoceanography. *Earth and Planetary Science*
400 *Letters* 257, 526-544.
401
- 402 Cripps, G.C., 1995. The occurrence of monounsaturated n-C₂₁ and polyunsaturated C₂₅
403 sedimentary hydrocarbons in the lipids of Antarctic marine organisms. *Polar Biol.* 15, 253-259.
404
- 405 Cripps, G.C. and Clarke, A., 1998. Seasonal variation in the biochemical composition of the
406 particulate material collected by sediment traps at Signy Island, Antarctica. *Polar Biol.* 20, 414-
407 423.
408
- 409 Crosta, X., 2009. Holocene size variations in two diatoms species, East Antarctica: productivity
410 vs environmental conditions. *Deep Sea Res. I* 56, 1983-1993.
411
- 412 Crosta, X., Romero, O., Armand, L.K., Pichon, J.J., 2005. The biogeography of major diatom
413 taxa in Southern Ocean sediments: 2. Open ocean related species Palaeogeography,
414 Palaeoclimatology, Palaeoecology 223, 66-92.
415
- 416 Dalsgaard, J., St. John, M., Kattner, G., Muller-Navarra, D., Hagen, W., 2003. Fatty acid and
417 trophic markers in the pelagic marine environment. *Advances in Marine Biology* 46, 225-340.
418
- 419 Dayton, P.K. and Oliver, J.S., 1977. Antarctic Soft-Bottom Benthos in Oligotrophic and
420 Eutrophic Environments. *Science* 197, 55-58.
421
- 422 DeMaster D. J., 2002. The accumulation and cycling of biogenic silica in the Southern Ocean:
423 revisiting the marine silica cycle. *Deep-Sea Res. II* 49, 3155-3167.
424
- 425 Ding, H. and Sun, M.-Y., 2005. Biochemical degradation of algal fatty acids in oxic and anoxic
426 sediment-seawater interface systems: effects of structural association and relative roles of
427 aerobic and anaerobic bacteria. *Mar. Chem.* 93, 1-19.
428
- 429 Domack, E., Duran, D., Leventer, A., Ishman, S., Doane, S., McCallum, S., Amblas, D., Ring, J.,
430 Gilbert, R., Prentice, M., 2005. Stability of the Larsen B ice shelf on the Antarctic Peninsula
431 during the Holocene epoch. *Nature* 436, 681-685.
432
- 433 Donegan, D. and Schrader, H., 1982. Biogenic and abiogenic components of laminated
434 hemipelagic sediments in the central Gulf of California. *Mar. Geol.* 48, 215-237.
435
- 436 Dunstan, G.A., Volkman, J.K., Barrett, S.M., Leroi, J-M, Jeffrey, S.W., 1994. Essential
437 polyunsaturated fatty acids from 14 species of diatom (Bacillariophyceae). *Phytochemistry* 35,
438 155-161.
439
- 440 Fahl, K. and Kattner, G., 1993. Lipid content and fatty acid composition of algal communities in
441 sea-ice and water from Weddell Sea (Antarctica). *Polar Biol.* 13, 405-409.
442
- 443 Falk-Petersen, S., Sargent, J.R, Lonne, O.J., Timofeev, S., 1999. Functional biodiversity in
444 lipids of Antarctic zooplankton: *Calanoides acutus*, *Calanus propinquus*, *Thysanoessa macrura*
445 and *Euphasia crystallorophias*. *Polar Biol.* 21, 37-47.
446
- 447 Farrington, J.W. and Quinn, J.G., 1973. Biogeochemistry of fatty acids in recent sediments from
448 Narragansett Bay, Rhode Island. *Geochim. Cosmochim. Acta* 37, 259-268.
449
- 450 Garrison, D.L., 1991. Antarctic sea ice biota. *American Zoologist* 31, 17-33.
451
- 452 Garrison, D.L., Buck, K.R., Fryxell, G.A., 1987. Algal assemblages in Antarctic pack ice and in
453 ice-edge plankton. *J. Phycol.* 23, 564-572.
454

- 455 Gille, S.T., 2002. Warming of the Southern Ocean Since the 1950s. *Science* 295, 1275-1277.
456
- 457 Grossi, V., Caradec, S., Gilbert, F., 2003. Burial and reactivity of sedimentary microalgal lipids in
458 bioturbated Mediterranean coastal sediments. *Mar. Chem.* 81, 57-69.
459
- 460 Haddad, R.I., Martens, C.S., Farrington, J.W., 1992. Quantifying early diagenesis of fatty acids
461 in a rapidly accumulating coastal marine sediment. *Org. Geochem.* 19, 205-216.
462
- 463 Holm-Hansen, O. and Mitchell, B.G., 1991. Spatial and temporal distribution of phytoplankton
464 and primary production in the western Bransfield Strait region. *Deep-Sea Res.* 38, 961-980.
465
- 466 Holm-Hansen, O., Hewes, C.D., Villafañe, V.E., Helbling, E.W., Silva, N., Amos, T., 1997.
467 Distribution of phytoplankton and nutrients in relation to different water masses in the area
468 around Elephant Island, Antarctica. *Polar Biol.* 18, 145-153.
469
- 470 Hu, J., Zhang, H., Peng, P., 2006. Fatty acid composition of surface sediments in the subtropical
471 Pearl River estuary and adjacent shelf, Southern China. *Estuarine, Coastal and Shelf Science*
472 66, 346-356.
473
- 474 Indarti, E., Abdul Majid, M.I., Hashim, R., Chong, A., 2005. Direct FAME synthesis for rapid total
475 lipid analysis from fish oil and cod liver oil. *Journal of food composition and analysis* 18, 161-
476 170.
477
- 478 Ingólfsson, Ó., Hjort, C., Berkman, P., Björck, S., Colhoun, E., Goodwin, I.D., Hall, B., Hirakawa,
479 K., Melles, M., Möller, P., Prentice, M., 1998. Antarctic glacial history since the Last Glacial
480 Maximum: an overview of the record on land. *Ant. Sci.* 10, 326-344.
- 481 Isla, E., Sañé, E., DeMaster, D.J. Utility of ^{210}Pb as a chronological tool for sediments off the
482 eastern Antarctic Peninsula: the case of the continental shelf under the extinct Larsen A and B
483 ice shelves. Unpublished results.
- 484 Kaneda, T., 1991. Iso- and anteiso-fatty acids in bacteria: biosynthesis, function and taxonomic
485 significance. *Microbiological Reviews* 55, 288-302.
- 486 Karpuz, N.K. and Jansen, E., 1992. A high-resolution diatom record of the last deglaciation from
487 the SE Norwegian Sea: documentation of rapid climatic changes. *Paleoceanography* 7, 499-520.
488
- 489 Laureillard, J., Pinturier, L., Fillaux, J., Saliot, A., 1997. Organic geochemistry of marine
490 sediments of the Subantarctic Indian Ocean sector: Lipid classes-sources and fate *Deep Sea*
491 *Res. II* 44, 1085-1108.
492
- 493 Lee, C., 1992. Controls on organic carbon preservation: The use of stratified water bodies to
494 compare intrinsic rates of decomposition in oxic and anoxic systems. *Geochim. Cosmochim.*
495 *Acta* 56, 3323-3335.
496
- 497 Leventer, A., 1991. Sediment trap diatom assemblages from the northern Antarctic Peninsula
498 region. *Deep-Sea Res.* 38, 1127-1143.
499
- 500 Lewis, T., Nichols, P.D., McMeekin, T.A., 2000. Evaluation of extraction method for recovery of
501 fatty acids from lipid-producing microheterotrops. *Journal of Microbiological Methods* 43, 107-
502 116.
503
- 504 Lipps, J.H., Ronan, T.E., DeLaca, T.E., 1979. Life below the Ross Ice Shelf, Antarctica. *Science*
505 203, 447-449.
506
- 507 Littlepage, J.L. and Pearse, J.S., 1962. Biological and oceanographic observations under an
508 Antarctic ice shelf. *Science* 137, 679-681.
509
- 510 Lü, D., Song, Q., Wang, X., 2010. Decomposition of algal lipids in clay-enriched marine

- 511 sediment under oxic and anoxic conditions Chinese Journal of Oceanology and Limnology 28,
512 131-143.
- 513
- 514 Nahon, S., Charles, F., Lantoine, F., Vétion, G., Escoubeyrou, K., Desmalades, M., Pruski,
515 A.M., 2010. Ultraviolet radiation negatively affects growth and food quality of the pelagic diatom
516 *Skeletonema costatum*. J. Exp. Mar. Biol. Ecol. 383, 164-170.
- 517
- 518 Nichols, P.D., Palmisano, A.C., Smith, G.A., White, D.C., 1986. Lipids of the Antarctic sea ice
519 diatom *Nitzschia cylindrus*. Phytochemistry 25, 1649-1653.
- 520
- 521 Nichols, D.S., Nichols, P.D., Sullivan, C.W., 1993. Fatty acid, sterol and hydrocarbon
522 composition of Antarctic sea ice diatom communities during the spring bloom in McMurdo
523 Sound. Antarctic Science 5, 271-278.
- 524
- 525 Parkes, R.J. and Taylor, J., 1983. The relationship between fatty acid distributions and bacterial
526 respiratory types in contemporary marine sediments. Estuar. Coast. Shelf Sc. 16, 173-189.
- 527
- 528 Perry, G.J., Volkman, J.M., Johns, R.B., Bavor, H.J., 1979. Fatty acids of bacterial origin in
529 contemporary marine sediments. Geochim. Cosmochim. Acta 43, 1715-1725.
- 530
- 531 Pike, J., Allen, C.S., Leventer, A., Stickley, C.E., Pudsey, C.J., 2008. Comparison of
532 contemporary and fossil diatom assemblages from the western Antarctic Peninsula shelf. Mar.
533 Micropal. 67, 274-287.
- 534
- 535 Reuss, N. and Poulsen, L., 2002. Evaluation of fatty acids as biomarkers for a natural bloom
536 community. A field study of a spring bloom and a post-bloom period off West Greenland. Mar.
537 Biol. 141, 423-434.
- 538
- 539 Riddle, M.J., Craven, M., Goldsworthy, P.M., Carsey, F., 2007. A diverse benthic assemblage
540 100 km from open water under the Amery Ice Shelf, Paleoceanography, 22. PA1204,
541 doi:10.1029/2006PA001327.
- 542
- 543 Roberts, D., Craven, M., Minghong, C., Allison, I., Nash, G., 2007. Protists in the marine ice of
544 the Amery Ice Shelf, East Antarctica. Polar Biol. 30, 143-153.
- 545
- 546 Rott, H., Skvarca, P., Nagler, T., 1996. Rapid collapse of northern Larsen Ice Shelf, Antarctica.
547 Science 271.
- 548
- 549 Rützler, K. and Macintyre, I.G., 1978. Siliceous sponge spicules in coral reef sediments. Mar.
550 Biol. 49, 147-159.
- 551
- 552 Sancetta, C., Heusser, L., Hall, M.A., 1992. Late Pliocene climate in the Southeast Atlantic:
553 preliminary results from a multidisciplinary study of DSDP Site 532. Mar. Micropal. 20, 59-75.
- 554
- 555 Schrader, H.J., and Gersonde, R., 1978. Diatoms and silicoflagellates. In Zachariasse,
556 W.J., et al. (Eds.), *Micropaleontological Counting Methods and Techniques: An Exercise*
557 *of an Eight Metres Section of the Lower Pliocene of Cap Rossello, Sicily*. Utrecht
558 Micropaleontol. Bull. 17, 129-176.
- 559
- 560 Smith, D.J., Eglinton, G., Morris, R.J., 1983. The lipid chemistry of an interfacial sediment from
561 the Peru Continental Shelf: Fatty acids, alcohols, aliphatic ketones and hydrocarbons. Geochim.
562 Cosmochim. Acta 47, 2225-2232.
- 563
- 564 Sañé, E., Isla, E., Grémare, A., Gutt, J., Vétion, G., DeMaster, D.J., 2011. Pigments in
565 sediments beneath a recently collapsed ice shelves: the case of Larsen A and B shelves,
566 Antarctic Peninsula. Journal of Sea Research, 65, 94-102.
- 567
- 568 Søreide, J.E, Falk-Petersen, Nøst Hegseth, E., Hop, H., Carroll, M.L., Hobson, K.A.,
569 Blachowiak-Samolyk, K., 2008. Seasonal feeding strategies of *Calanus* in the high Arctic
570 Svalbard region. Deep-Sea Res. II 55, 2225-2244.

- 571
572 Sun, M.-Y. and Wakeham, S.G., 1994. Molecular evidence for degradation and preservation of
573 organic matter in the anoxic Black Sea Basin. *Geochim Cosmochim. Acta* 58, 3395-3406.
- 574 Sun, M.-Y., Wakeham, S.G., Lee, C., 1997. Rates and mechanisms of fatty acid degradation in
575 oxic and anoxic coastal marine sediments of Long Island Sound, New York, USA. *Geochim*
576 *Cosmochim. Acta* 61, 341-355.
- 577 Tsoy, I.B., Obrezkova, M.S., Artemova, A.V., 2009. Diatoms in Surface Sediments of the Sea of
578 Okhotsk and the Northwest Pacific Ocean. *Oceanology* 49, 130-139.
- 579
580 Vaughan, D.G., Marshall, G.J., Connolley, W.M., King, J.C., Mulvaney, R., 2001. Devil in the
581 Detail. *Science* 293, 1777-1779.
- 582
583 Venkatesan, M.I., 1988. Organic geochemistry of marine sediments in Antarctic region: marine
584 lipids in McMurdo Sound. *Org. Geochem.* 12, 13-27.
- 585
586 Venkatesan, M. and Kaplan, I., 1987. The lipid geochemistry of Antarctic marine sediments:
587 Bransfield Strait. *Mar. Chem.* 21, 347-375.
- 588
589 Volkman, J.K., Johns, R.B., Gillan, F.T., Perry, G.J., 1980. Microbial lipids of an intertidal
590 sediment-I. Fatty acids and hydrocarbons. *Geochim. Cosmochim. Acta* 44, 1133-1143.
- 591
592 Volkman, J.K., Jeffrey, S.W., Nichols, P.D., Rogers, G.I., Garland, C.D., 1989. Fatty acid and
593 lipid composition of 10 species of microalgae used in mariculture. *J. Exp. Mar. Biol. Ecol.* 128,
594 219-240.
- 595
596 Wakeham, S.G., 1995. Lipid biomarkers for heterotrophic alteration of suspended particulate
597 organic matter in oxygenated and anoxic water columns of the ocean. *Deep-Sea Res. I* 42,
598 1749-1771.
- 599
600 Wakeham, S.G., Hedges, J.I., Lee, C., Peterson, M.L., Hernes, P.J., 1997. Compositions and
601 transport of lipid biomarkers through the water column and surficial sediments of the equatorial
602 Pacific Ocean. *Deep-sea Res. II* 44, 2131-2162.
- 603
604 Wright, S.W. and van den Enden, R.L., 2000. Phytoplankton community structure and stocks in
605 the East Antarctic Marginal ice zone (BROKE survey, January-March 1996) determined by
606 CHEMTAX analysis of HPLC pigment signatures. *Deep-Sea Res. II* 47, 2363-2400.
- 607
608

609 **Table 1.** Inventories and fluxes of diatom valves.
610

Core station	Diatom valves inventory (Diatoms cm ⁻²)	Diatom valves flux (Diatoms cm ⁻² yr ⁻¹)
LBS	4765774	9353155
LBW	4700737	940147
LBC	35260876	7052175
LBN	13045842	2609168
LA	25056923	5011385

611
612
613

Accepted manuscript

614 >Sediments were studied to see if changes in the water column reflect in
615 sediments.>Sediments off the Northern and the Eastern Antarctic Peninsula were
616 compared.>2 ice shelf collapses in 1995 and 2002 affected the Eastern Antarctic
617 Peninsula.>The lability of the organic matter was higher in the Northern than in the
618 Eastern Antarctic Peninsula.>Diatom valves were deposited only after the ice shelves
619 collapses.
620
621

Accepted manuscript

622 Figure caps
623 Figure 1: Study area with the five sampling stations.
624 Figure 2: Diatom valves profiles in LBS, LBW, LBC, LBN and LA.
625 Figure 3: Sea ice taxa, *Chaetoceros* spp., *F. kerguelensis*, *T. antarctica* and non
626 dominant taxa in EAP.
627 Figure 4: Diatom (14:0 and 16:1(n-7), dinoflagellate (16:0, 18:1(n-9)cis), zooplankton
628 (20:1(n-9) and 22:1(n-9) and bacteria (11:0, 13:0 and 15:0) FA indicators in EAP.
629 Figure 5: PUFA, MUFA, LC-FA and MC-FA in EAP.
630 Figure 6: Chla concentration, diatom valves abundance and excess ²¹⁰Pb activity in the
631 EAP region.
632
633
634

Accepted manuscript

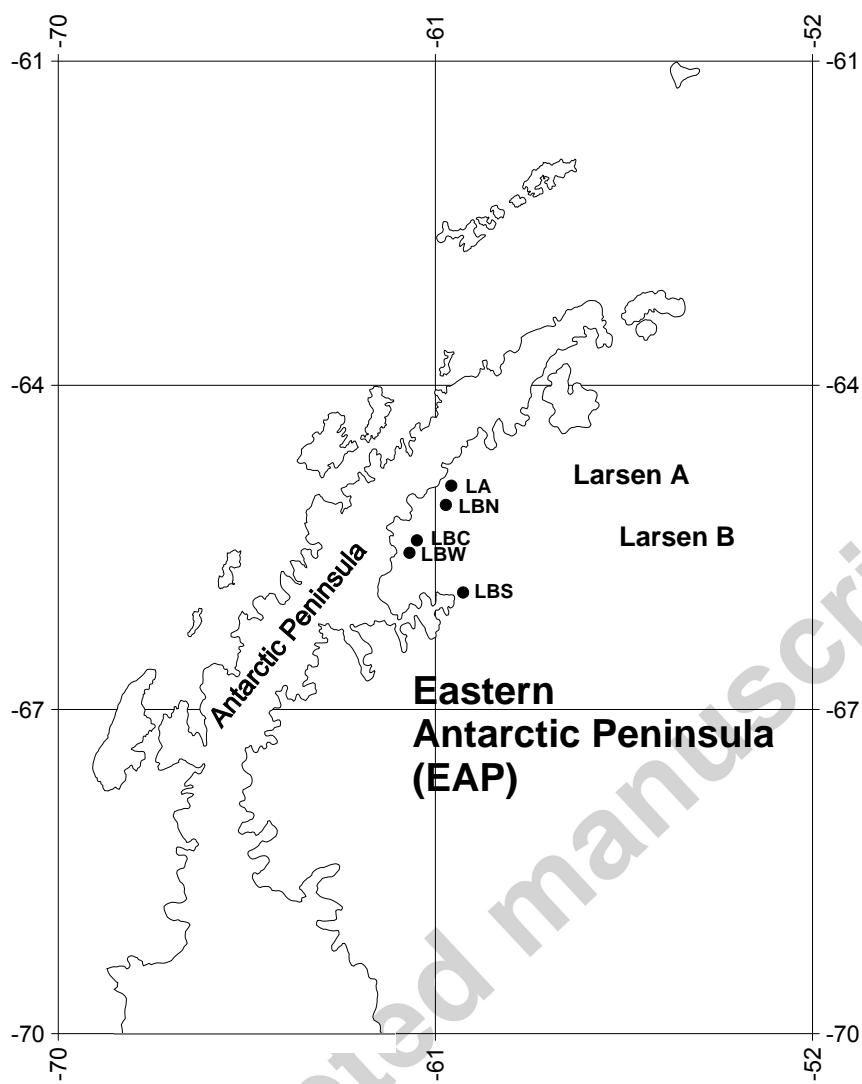
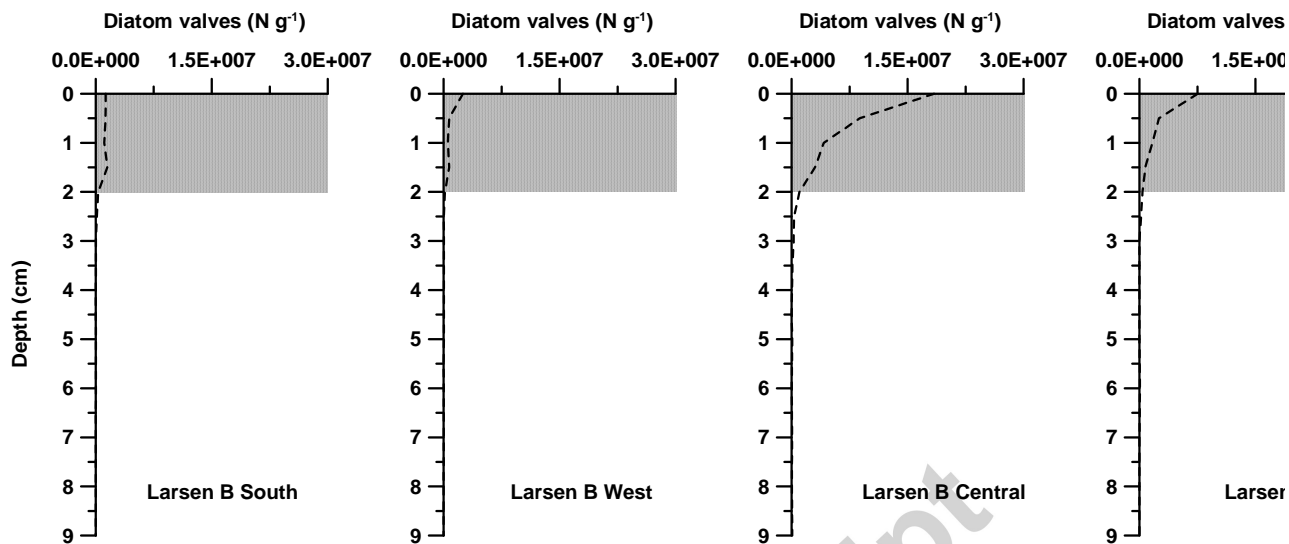


Fig. 1

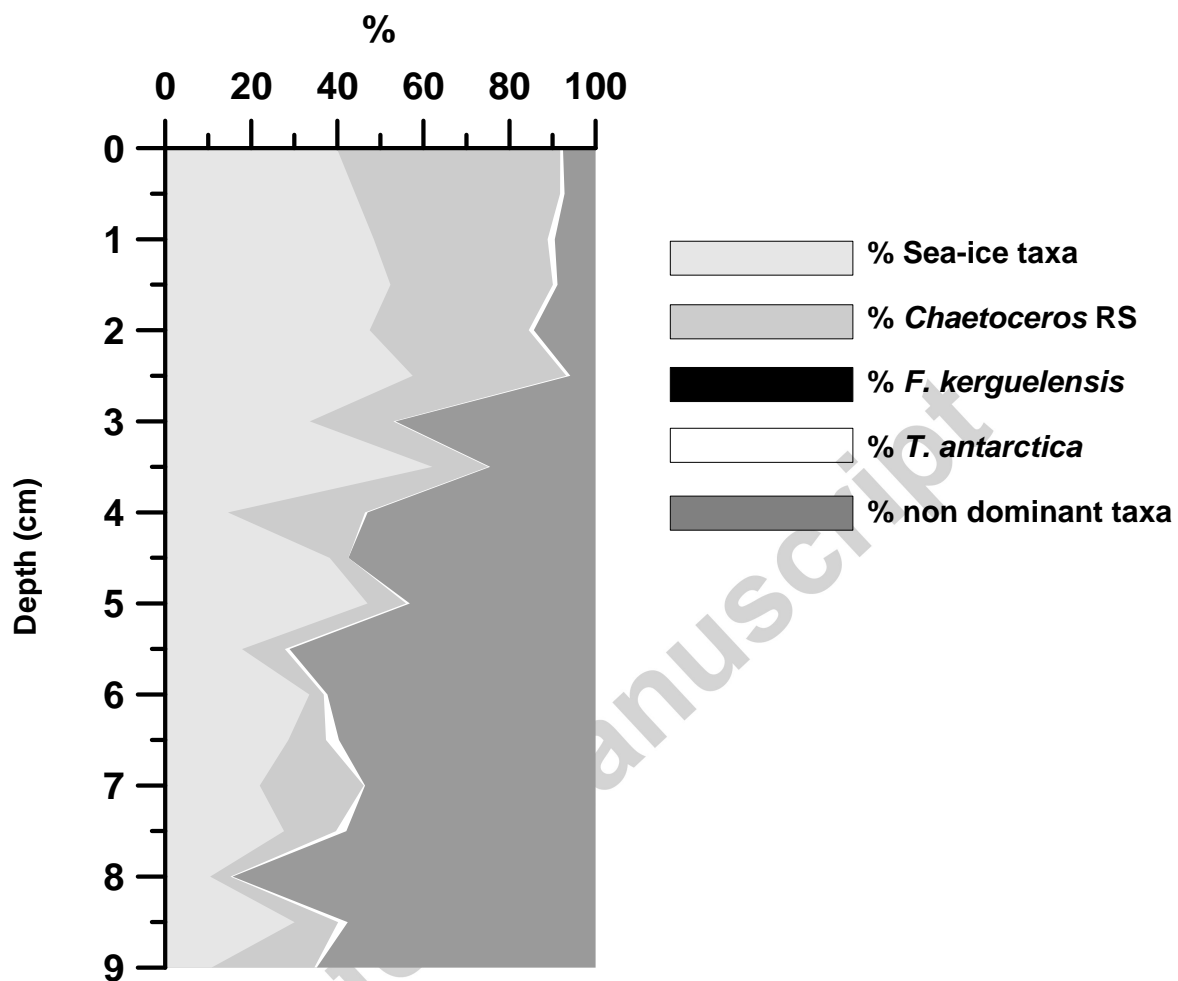
635
636
637
638
639
640
641
642
643



644
645
646
647
648
649
650
651
652

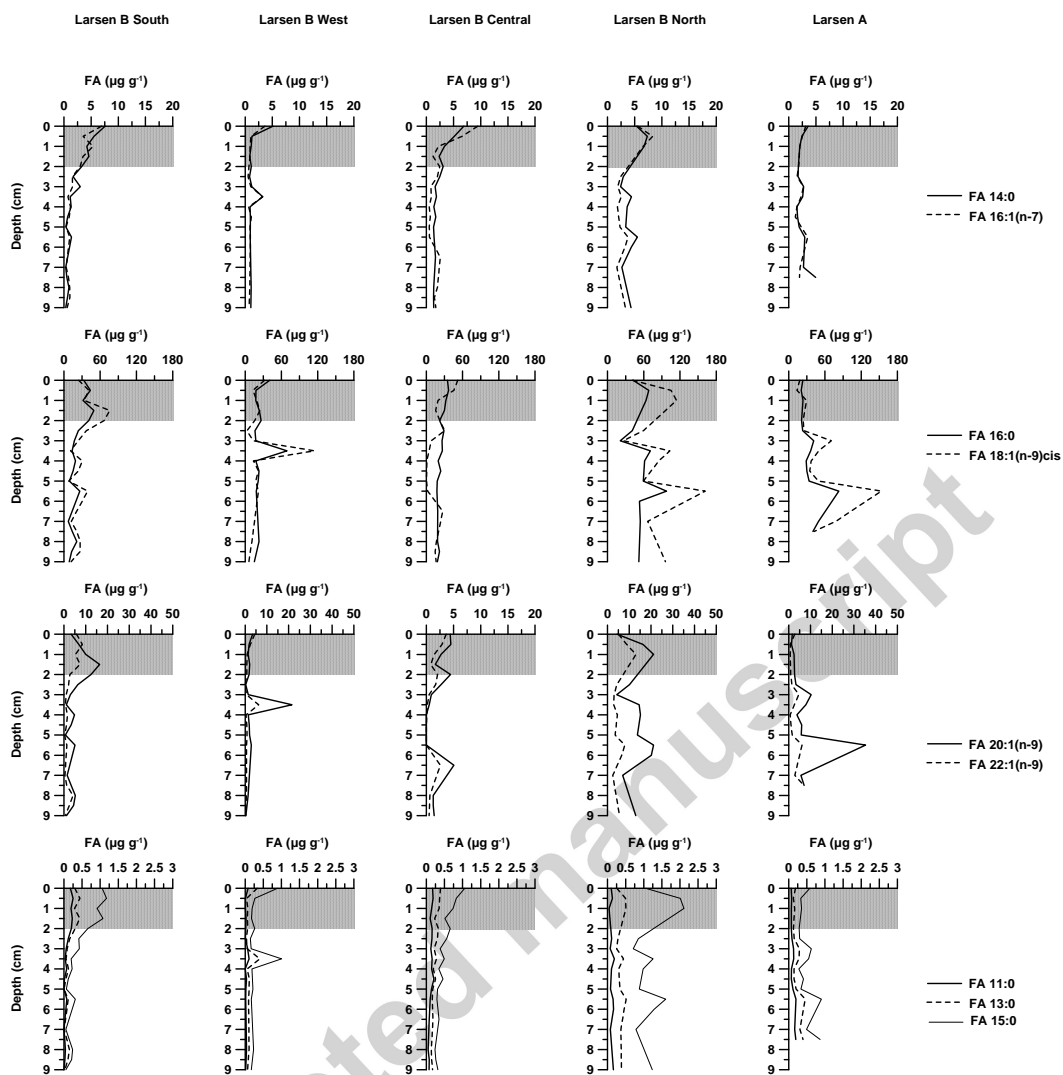
Fig. 2

Accepted manuscript



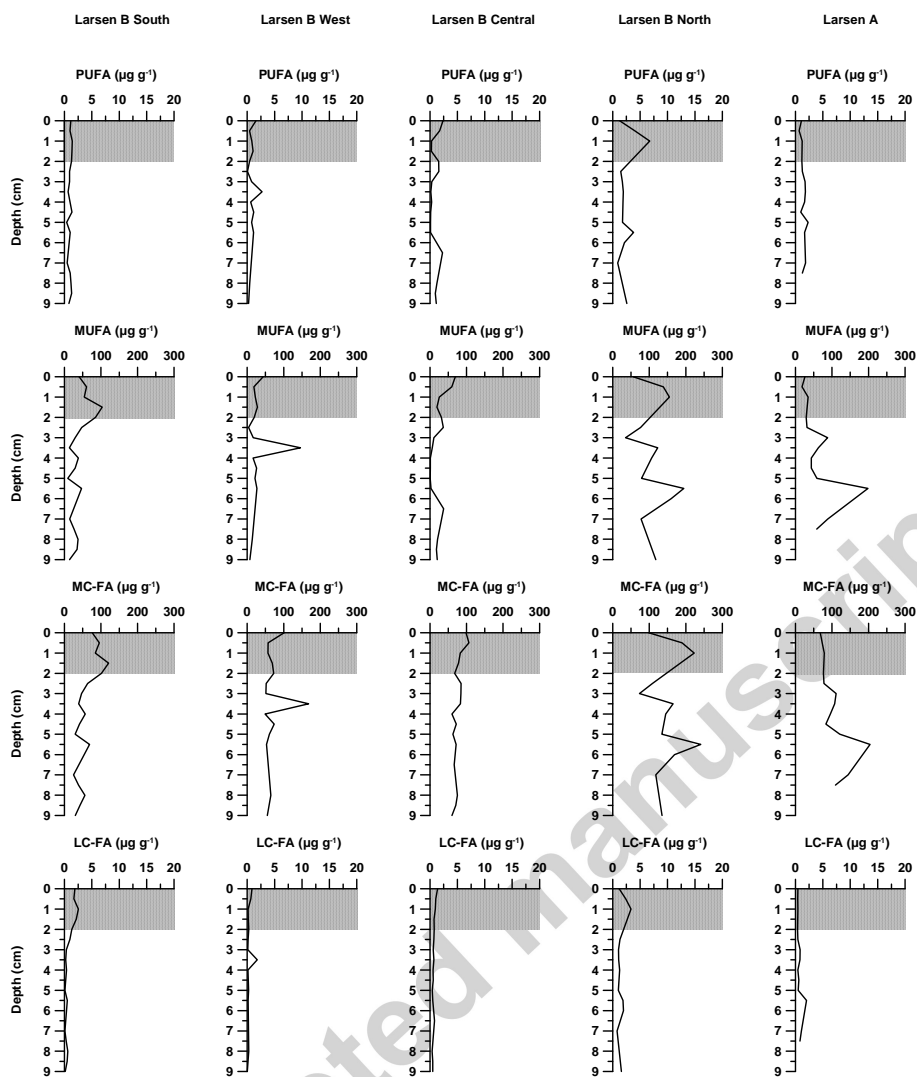
653
654

Fig. 3



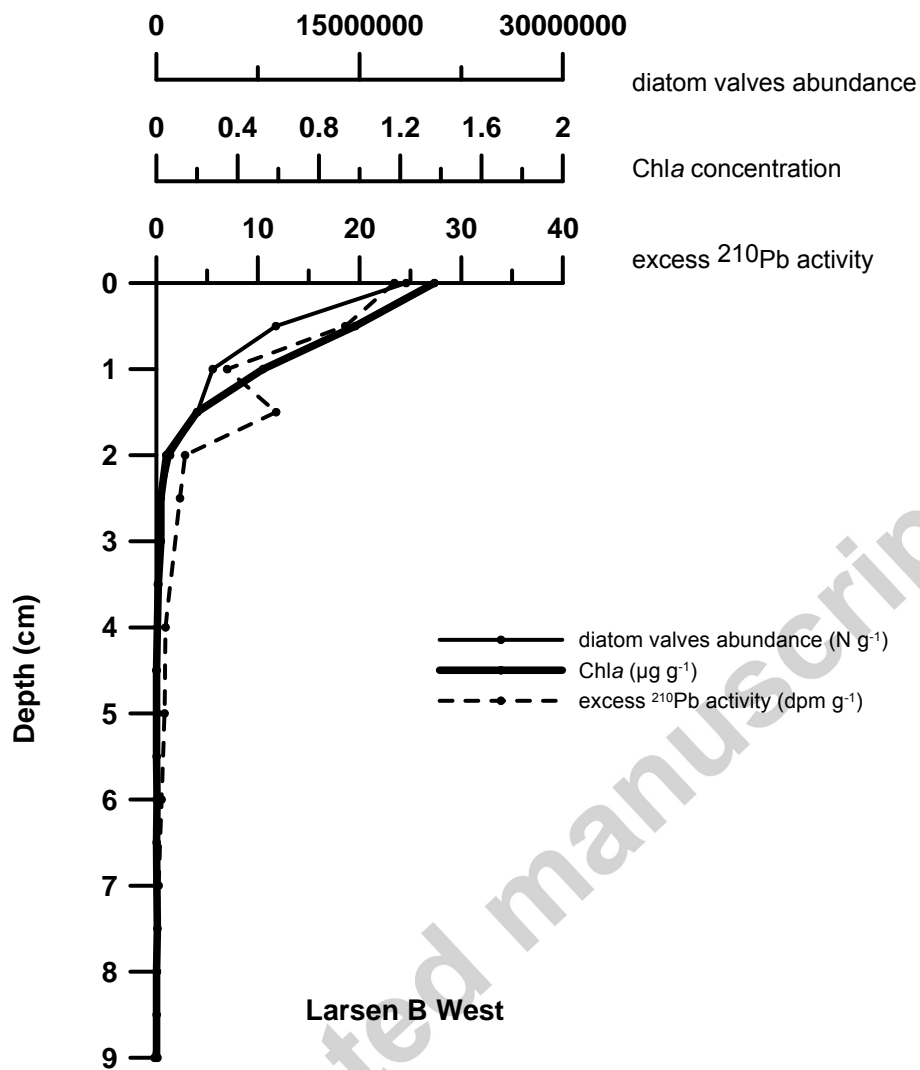
655
656

Fig. 4



657

Fig.5



658
659

Fig.6