Variability of organic carbon along the ice-covered polar continental margin of East Greenland

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Abstract

The Nordic Seas play an important role in the global climate system. The detailed knowledge and comprehension of recent processes is essential for predicting future climate as well as for reconstructing paleoenvironmental conditions. In order to examine these processes controlling, among other things, the variability of organic carbon in modern sediments of the ice-covered polar continental margin of East Greenland, organic-geochemical bulk parameters (C/N-ratios, hydrogen- and oxygen-index values, T_{max}-values) and specific biomarkers (*n*-alkanes, fatty acids, sterols) in marine surface sediments, onshore sediments originating from Greenland, and sea-ice sediments were determined. Based on literature and compound-specific stable carbon isotope measurements, the investigated biomarkers were assigned to three different groups representing (a) primary production (phytoplankton, sea-ice algae), (b) secondary input (zooplankton, bacteria), and (c) terrestrial production (higher plants). Primary production- and secondary input-derived biomarkers showed highest concentrations in the shallow fjord and shelf sediments. Degradation processes in the water column and at the sediment-water interface mainly control their distribution as in slope and deep-sea sediments only low concentrations were detected. The higher marine production rate of the marginal ice zone was not reflected in surface sediments. The amounts of higher plant-derived biomarkers were highest in sediments of the marginal ice zone indicating the predominant input of these compounds by melting sea ice. The lowest concentrations of higher plant-derived biomarkers were measured in the fjord and shelf sediments pointing to a negligible input of terrigenous organic carbon direct from Greenland. This study has shown that the distribution and composition of organic carbon in modern sediments of the East Greenland continental margin is primarily controlled by degradation. In addition to the investigation of surface sediments, the organic-carbon records of selected sediment cores were determined to develop a rough model for the variability of organic carbon during the Late Quaternary.

Kurzfassung

Das Europäische Nordmeer ist eine der Schlüsselregionen des globalen Klimasystems. Sowohl für die Vorhersage der zukünftigen Klimaentwicklung als auch für die Rekonstruktion von Paläoumweltbedingungen ist ein genaues Wissen und Verständnis der rezenten Prozesse von großer Bedeutung. Um diese Prozesse, die unter anderem auch die Variabilität von organischem Kohlenstoff steuern, zu untersuchen, wurden Oberflächensedimente vom eisbedeckten ostgrönländischen Kontinentalrand, Meereissedimente und grönländische Strandsedimente beprobt. Um Aussagen über die Verteilung und Zusammensetzung des organischen Kohlenstoffs machen zu können, wurden an diesen Proben organisch-geochemische Basisparameter (C/N-Verhältnisse, Wasserstoff- und Sauerstoffindex, T_{max}-Werte) und Konzentrationen spezifischer Biomarker (*n*-Alkane, Fettsäuren, Sterole) bestimmt. Basierend auf Literaturangaben und komponentenspezifischen Messungen stabiler Isotope wurden die Biomarker in folgende drei Gruppen unterteilt: (a) algenspezifische Biomarker, (b) zooplankton- und bakterienspezifische Biomarker und (c) landpflanzenspezifische Biomarker. Biomarker der ersten beiden Gruppen erreichten in den Proben der flachen Stationen der Fjorde und des Schelfs höchste Konzentrationen. Degradationsprozesse in der Wassersäule und an der Sediment-Wasser Grenzfläche bedingten niedrige Konzentrationen von algen-, zooplankton- und bakterienspezifischen Biomarkern in Proben aus größerer Wassertiefe. Die erhöhte biologische Produktion im Oberflächenwasser der Eisrandzone spiegelt sich nicht in den Sedimenten wieder. Jedoch wurden in den Sedimenten der Eisrandzone höchste Konzentrationen von landpflanzenspezifischen Biomarkern gemessen. Dieses deutet auf einen Haupteintrag dieser Komponenten durch abschmelzendes Meereis hin. Die geringen Konzentrationen landpflanzenspezifischer Biomarker in den küstennahen Stationen zeigen, dass Grönland als Liefergebiet für diese Komponenten nur eine untergeordnete Rolle spielt. Diese Arbeit hat gezeigt, dass die Verteiltung und Zusammensetzung von organischem Kohlenstoff an erster Stelle durch die Degradation gesteuert wird. Ergänzend wurden die Gehalte von organischem Kohlenstoff in ausgesuchten Sedimentkernen untersucht. Die Daten bildeten die Grundlage für ein einfaches Modell für die Erklärung der Variabilität von organischem Kohlenstoff während des Spätquartärs.

1 Introduction

The Nordic Seas play an important role in the global climate system. Although they cover a small fraction of the globe, positive feedback between the Nordic Seas and the climate system has the potential to cause global effects (ACIA, 2004). The Nordic Seas hold a crucial position within the global thermohaline circulation system (THC), known as the "Oceanic Conveyor Belt" (Broecker, 1997; 2000; Hansen et al., 2004). Among other effects, the THC is responsible for the relative warm climate of Northern Europe as it delivers an enormous amount of heat to the northern Atlantic (e.g., Broecker, 1997; Rahmstorf, 2002). The large areas of the Nordic Seas are seasonally covered by sea ice (Martin and Wadhams, 1999). Sea ice constrains the exchange of heat and other properties between the atmosphere and ocean, controls the biological production, and functions as a transport medium for terrigenous material. Therefore, it has a significant impact on the organic carbon cycle (e.g., ACIA, 2004; Stein and Macdonald, 2004b).

The burial of organic carbon in sediments is controlled by various mechanisms including primary production of the surface water, supply of terrigenous organic matter, biogeochemical processes in the water column and at the seafloor, and sedimentation rate (e.g., Müller and Suess, 1979; Stein, 1991; Hedges and Keil, 1995; Harnett et al., 1998). In this context, little is known about the contribution of these processes to the accumulation of organic carbon in sediments of the Nordic Seas and its changes in geological times. Therefore, the original objective of this study was to investigate the distribution and composition of organic carbon in present and past environments north and south of the Denmark Strait. For this purpose, organic-geochemical bulk parameter and biomarker analyses should be conducted on surface sediment samples and selected sediment cores, taken during the RV *Polarstern* expedition ARK-XVIII/1 in 2002 (Lemke, 2003). However, first measurements have shown that the organic carbon contents in the sediment cores were too low to perform biomarker analysis. As a consequence, the original objective has changed, and the detailed investigation of the distribution and composition of organic carbon in surface sediment samples of the ice-covered polar continental margin of East Greenland and the evaluation of the different controlling processes have become the main purpose of the present thesis. For the investigated sediment cores, only a short discussion of the variability in total organic carbon has been included. Prior to this study, the knowledge of the distribution of organic carbon in surface sediments of the East Greenland continental margin was restricted to single point measurements (Taylor et al., 2002 and references therein) and investigations of the composition of the organic matter were not available until now. In order to fill this gap in knowledge, marine surface sediment samples and additional onshore sediment samples of the source areas of terrigenous material (i.e, Greenland) as well as sea-ice samples were intensively studied for organic-geochemical bulk parameters and biomarkers. The samples were taken during five expeditions of RV *Polarstern* at the East Greenland continental margin between 60 and 76°N (Hubberten, 1994; Krause and Schauer, 2001; Fahrbach, 2002; Lemke, 2003; Jokat, 2004). Biomarker data have largely been used as organic-carbon source indicators reflecting recent environmental conditions (e.g., Fahl and Stein, 1997; 1999; Schubert and Stein, 1997; Fahl et al., 2003; Birgel et al., 2004).

In order to identify and distinguish processes (i.e., autochthonous and allochthonous input) and the influence of environmental aspects (e.g., sea-ice cover) on the deposition of organic carbon in sediments, the following main questions are to be answered:

- Are there distinct patterns in the distribution of organic carbon and carbonate in modern sediments of the entire Nordic Seas?
- How does the sea ice influence the distribution and composition of organic carbon in modern sediments of the ice-covered polar continental margin of East Greenland?
- Is an enhanced biological production of marine organic matter reflected in surface sediments?
- Which sources are to be considered for the supply and input of terrigenous organic matter?
- How important are degradation processes in the water column and at the sediment-water interface?
- Is it possible to give at least some first information about the changing environmental conditions based on total organic carbon records?

2 Working Area Nordic Seas

The modern physiography of the Nordic Seas is characterised by complex morphological structures, which were the result of the plate tectonic separation of Greenland and Eurasia and the opening of the North Atlantic. The developed structures were modified during the Plio-/Pleistocene glaciations of the Northern Hemisphere. Especially the coastal regions were affected by the glacial overprint and as a result fjords were formed and the shelves were deepened. The large amounts of sediments, which were supplied by glaciers, changed the shape of the continental margins and were to some extent transported further into the deep sea mainly by gravity-driven mass movements. Additionally ice-rafted debris (IRD) was distributed over the entire Nordic Seas. The Plio-/Pleistocene physiography of the Nordic Seas controls the circulation and distribution of water masses and the deep-water renewal. The oceanographic settings changed between glacial and interglacial times as a result of a varying sea level and glacial rebound processes. The ice cover plays a significant role for the transport of lithogenic and biogenic material and for the distribution of primary production. In turn the primary production influences the structure of the food web and the export of organic matter.

2.1 Bathymetry and Physiography

The Nordic Seas, consisting of the Greenland, Iceland and Norwegian Seas, connect the Arctic Ocean with the North Atlantic Ocean. They cover an area of 2.864 million km^2 and have a volume of 4.269 million km^3 (Jakobsson, 2002). The Greenland-Spitsbergen Sill in the north, Greenland in the west, the Greenland-Scotland Ridge in the south and Scandinavia, the Barents Sea and Svalbard in the east, border them (Johnson et al., 1990). The Nordic Seas are subdivided by first order topographic features such as the mid-ocean ridges, deep basins, continental shelves, and shelf margins (Vogt, 1986) (Figure 2.1).

The Iceland Sea is situated between Greenland, Iceland and Jan Mayen, and the Kolbeinsey Ridge divides it in a western and an eastern part. The Kolbeinsey Ridge, a part of the mid-ocean ridge system, reaches from Iceland up to the Jan Mayen Fracture Zone, which is the northern boundary of the Iceland Sea. West of the ridge, two smaller basins are situated: the Blosseville Basin and the Scoresby Basin. A 1500 m deep sill separates these in average 1600 m deep basins. The Denmark Strait, is characterised by a shallow sill with a maximum water

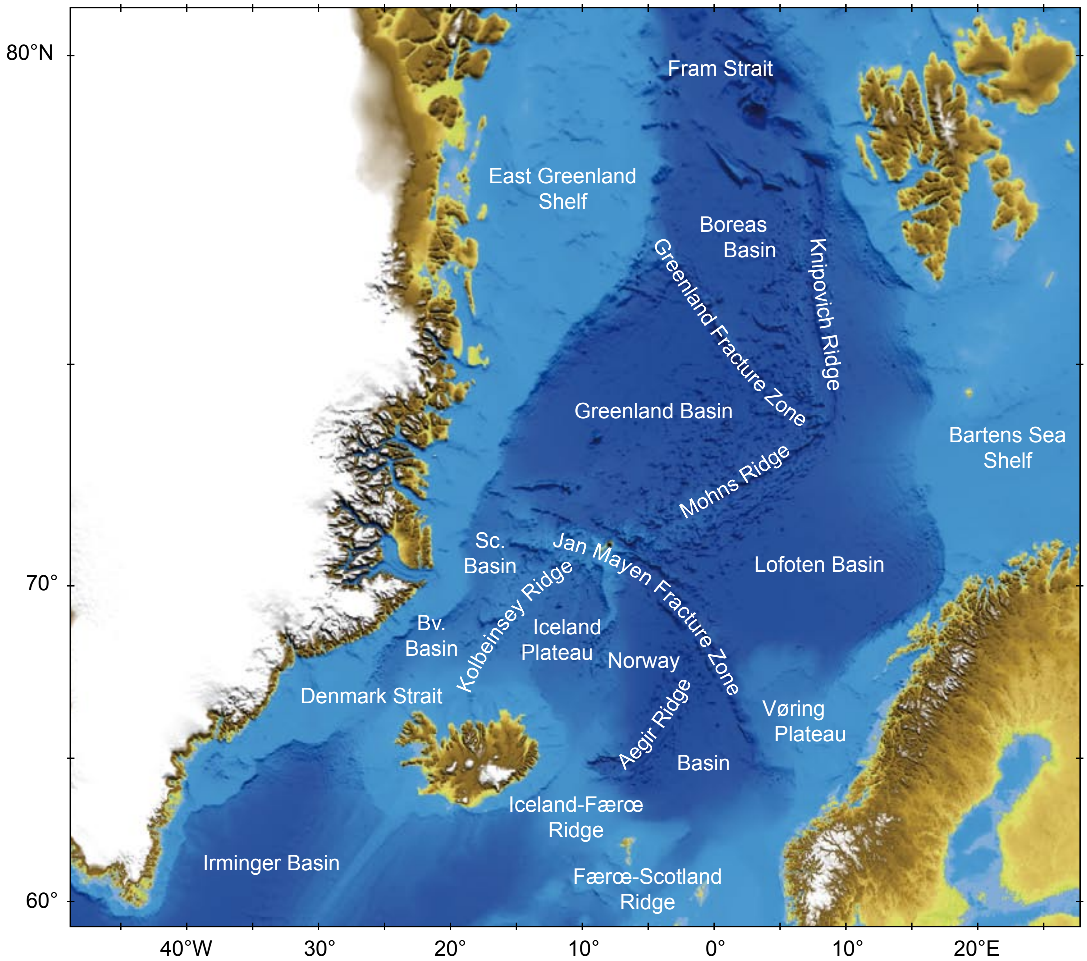


Figure 2.1 Main bathymetric features in the Nordic Seas (modified after Eldholm et al., 1990; Jakobsson et al., 2000). Sc. Basin = Scoresby Basin, Bv. Basin = Blosseville Basin.

depth of 600 m and located south of the Blosseville Basin, is the boundary to the North Atlantic Ocean. The Iceland Plateau follows east of the Kolbeinsey Ridge with a depth range between 1800 and 2000 m. The shallowest water depths in the Iceland Sea of about 150-300 m occur on the East Greenlandic and Icelandic shelves.

The Greenland Sea is bounded by the Greenland-Spitsbergen Sill in the north, Greenland in the west, the Jan Mayen Fracture Zone in the south, and the mid-ocean ridge system, consisting of the Mohns and the Knipovich Ridge, in the east. The Greenland Sea is composed of parts of the East Greenland continental shelf and slope and two deep basins: the smaller and shallower Boreas Basin (3200 m) and the deeper Greenland Basin (3600-3700 m). The Greenland Fracture Zone with a general water depth of 2000 m separates the two basins from each other. The Greenland-Spitsbergen Sill connects the Greenland Sea with the Arctic

Ocean. Their deepest part, the Fram Strait, has a maximum water depth of 2600 m. The East Greenland continental shelf can be characterised as a region of shallow banks and local depressions, with large cross-shelf troughs cut into the bedrock (Perry, 1986). The shelf width varies between 30 km and 280 km, and the shelf depth is on the average 100-300 m. The Jan Mayen Fracture Zone, which separates the Greenland Sea from the Iceland Sea, has a depth of 2200 m in general. The Mohns Ridge and the Knipovich Ridge, both parts of the mid-ocean ridge system, form the eastern boundary of the Greenland Sea.

The Norwegian Sea is made up the Lofoten Basin, the Norwegian Basin, the Vøring Plateau and the Norwegian continental shelf and slope. The Jan Mayen Fracture Zone strikes from Jan Mayen towards the Vøring Plateau, and it is the boundary between the shallower (3200 m) northern Lofoten Basin and the deeper (3200-3800 m) southern Norwegian Basin. The Aegir Ridge in the Norwegian Basin is an extinct part of the mid-ocean ridge system. The Iceland-Scotland Ridge, consisting of the Iceland-Færœ Ridge and the Færœ-Shetland Trough, is the southern boundary of the Norwegian Sea and represents among the Denmark Strait another connection between the Nordic Seas and the North Atlantic Ocean. The sill depth of the Iceland-Færœ Ridge and the Færœ-Shetland Trough is 600 m and 900 m, respectively.

2.2 Plate Tectonic Evolution

The complex pattern of mid-ocean ridges and fracture zones in the Nordic Seas is a result of the plate tectonic separation of Eurasia and Greenland and the opening of the North Atlantic (Vogt, 1986; Eldholm et al., 1990; Boebel, 2000) (Figure 2.2). Cenozoic sea-floor spreading in the Norwegian-Greenland Sea was initiated during the time period between magnetic anomalies 25 and 24B close to Paleocene/Eocene boundary. The continental crust between Norway and Greenland, which had been stretched by several tensional episodes during Mesozoic times, was further thinned, and oceanic crust was generated. Subsequent to the start of sea-floor spreading, the initial ocean gradually widened and deepened (Eldholm et al., 1990). Up to anomaly 13 the sea floor spreading had taken place only in the southern Greenland Sea. Then, the plate tectonic evolution had changed, as Greenland became part of the North America plate. Since anomaly 13, oceanic crust was generated along the entire plate boundary between Svalbard and Greenland, and the opening of the Fram Strait finally resulted in a deep water connection between the Arctic and North Atlantic oceans (Thiede et

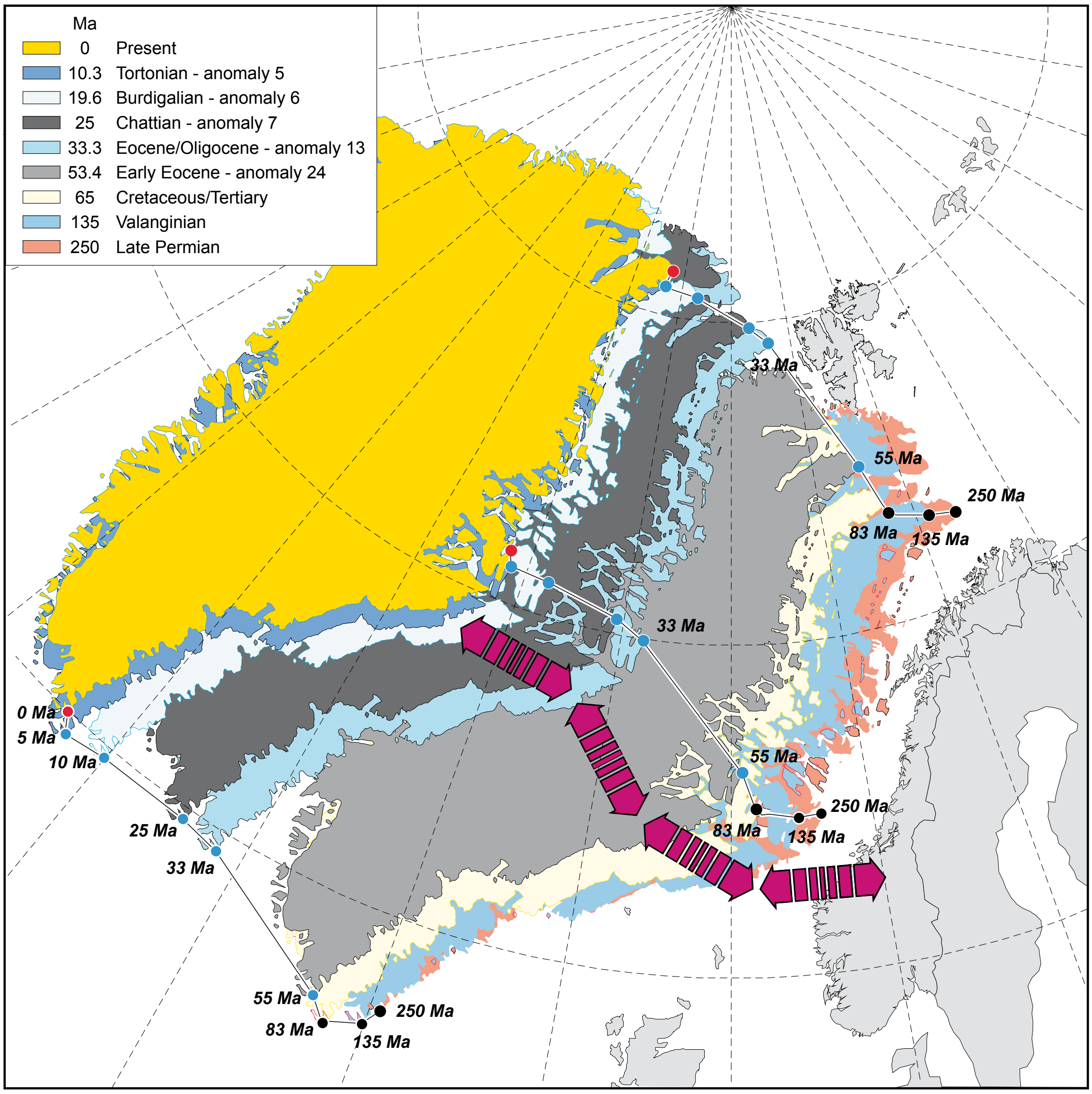


Figure 2.2 Plate reconstructions for Greenland versus Europe according to revised rotation poles with Europe fixed. To highlight opening directions, the successive positions of Greenland are shown, and the dots and connecting lines show the trajectory of three distinct points on Greenland. The large arrows qualitatively indicate the main different successive opening directions (modified after Mosar et al., 2002).

al., 1998). For a more detailed description of the plate-tectonic evolution of the Nordic Seas see e.g. Ziegler (1989) and Eldholm et al. (1990).

2.3 Glacial History

The earliest phase of Northern Hemisphere glaciations is documented in glacial deposits of the Nordic Seas in the middle Miocene, at approximately 14 Ma (Solheim et al., 1996a; Thiede et al., 1998). Results from ocean drilling indicates a further stepwise increase of Northern Hemisphere cooling by several IRD pulses during late Miocene (7.2, 6.8 and 6.3 Ma), which ultimately culminated in a drastic intensification of Northern Hemisphere glaciation during late Plio-Pleistocene (Thiede et al., 1998). A strengthening of IRD pulses in deep-sea sediments from the western Nordic Seas and the Labrador Sea is documented since approximately 4 Ma. In contrast, a strengthening of IRD pulses in the eastern Nordic Seas and the Barents Sea occurred later between 3.2 and 2.7 Ma (Thiede et al., 1998). The large-scale late Plio-Pleistocene glaciations started at 2.56 Ma, and they resulted in a strong supply of IRD to the Nordic Seas and the North Atlantic. They were characterised by frequency domains related to 41 ka periods of obliquity (Thiede et al., 1998). Marine sediments from the subsequent interval between 1.2 to 0.6 Ma show generally high carbonate contents. Then the frequency domain changed and the last 600-700 ka were dominated by 100 ka periods of eccentricity, which were displayed in high-amplitude oscillations of the carbonate content in marine sediments (e.g. Mangerud et al., 1996; Solheim et al., 1996b). In the Northern Hemisphere the last glaciation, the Last Glacial Maximum (LGM), culminated in the period between 21 and 16 ka (Funder and Hansen, 1996; Funder et al., 1998), and the supply of coarse-grained IRD into the sediments of the East Greenland continental margin reached maximum values (Andrews et al., 1997; Nam and Stein, 1999). According to Evans et al. (2002) a middle-shelf moraine represents the maximum shelfward extent of the Greenland Ice Sheet during the LGM north of Scoresby Sund whereas the ice sheet reaches the shelf break south of Scoresby Sund (Funder and Hansen, 1996; Andrews et al., 2000; Geirsdóttir, 2004) (Figure 2.3). During the following deglaciation the ice sheets of the Northern Hemisphere melted and eustatic and isostatic changes occurred. The decay of the land-based ice sheet was responsible for the accompanying glacio-isostatic crustal rebound as well as for the eustatic sea-level rising (Bennike et al., 2002; Fleming and Lambeck, 2004). The deglaciation of the Greenland Ice Sheet and its retreat from the East Greenland continental shelf began after 15.3 ka. At this time a marked decrease in IRD at the continental slope, a change in sedimentary facies and an increase in marine organic carbon occurred (Nam et al., 1995; Funder et al., 1998) (Figure 2.4).

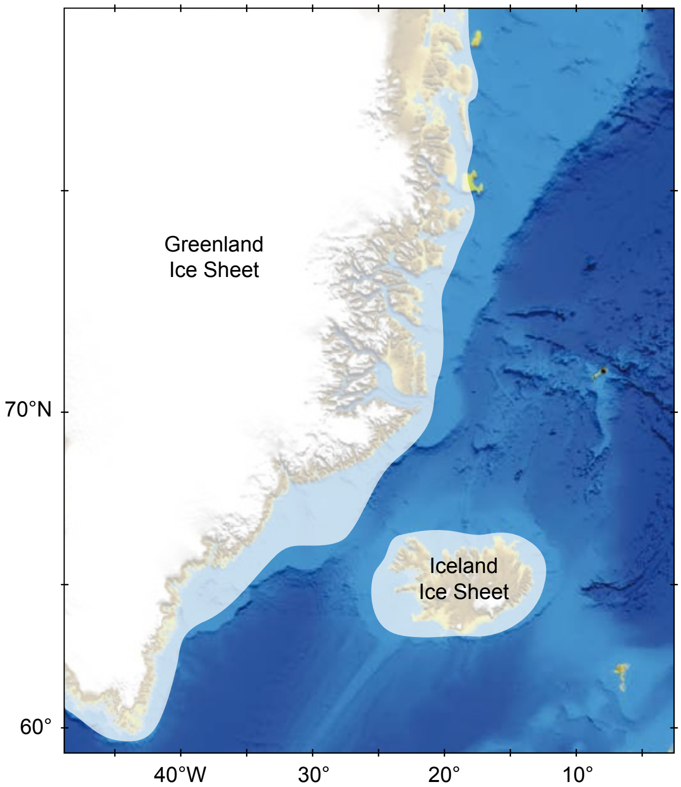


Figure 2.3 Model of the Greenland and Iceland ice sheet during the Last Glacial Maximum (modified after Funder and Hansen, 1996; Geirsdóttir, 2004 and references therein).

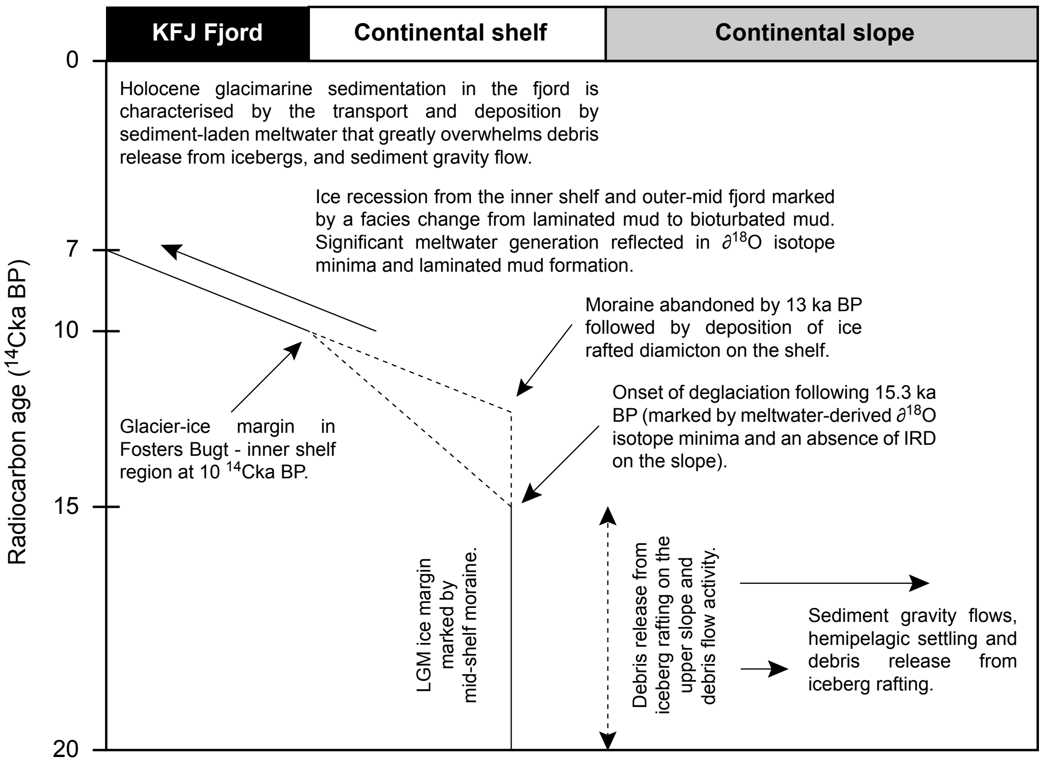


Figure 2.4 Time-distance diagram of the Late Weichselian and Holocene glacial and sedimentation history of Kejser Franz Joseph Fjord and adjacent continental margin (Evans et al., 2002).

2.4 Oceanography

The modern Nordic Seas circulation is characterised by a large-scale cyclonic gyre with a strong barotrop component, which is wind-driven and controlled by topography (Carmack and Aagaard, 1973; Johannessen, 1986; Cisewski, 2000; Oliver and Heywood, 2003). Two major current systems dominate the surface circulation in the Nordic Seas. The North Atlantic Current (NAC) carries warm Atlantic source waters across the Greenland-Scotland Ridge into the eastern part of the Nordic Seas. The counterpart on the western side is the East Greenland Current (EGC) which transports cold Polar source waters from the Arctic Ocean through Fram Strait into the Nordic Seas (Figure 2.5). The interaction of the different water masses leads to distinct hydrographic gradients (Johannessen, 1986; Swift, 1986).

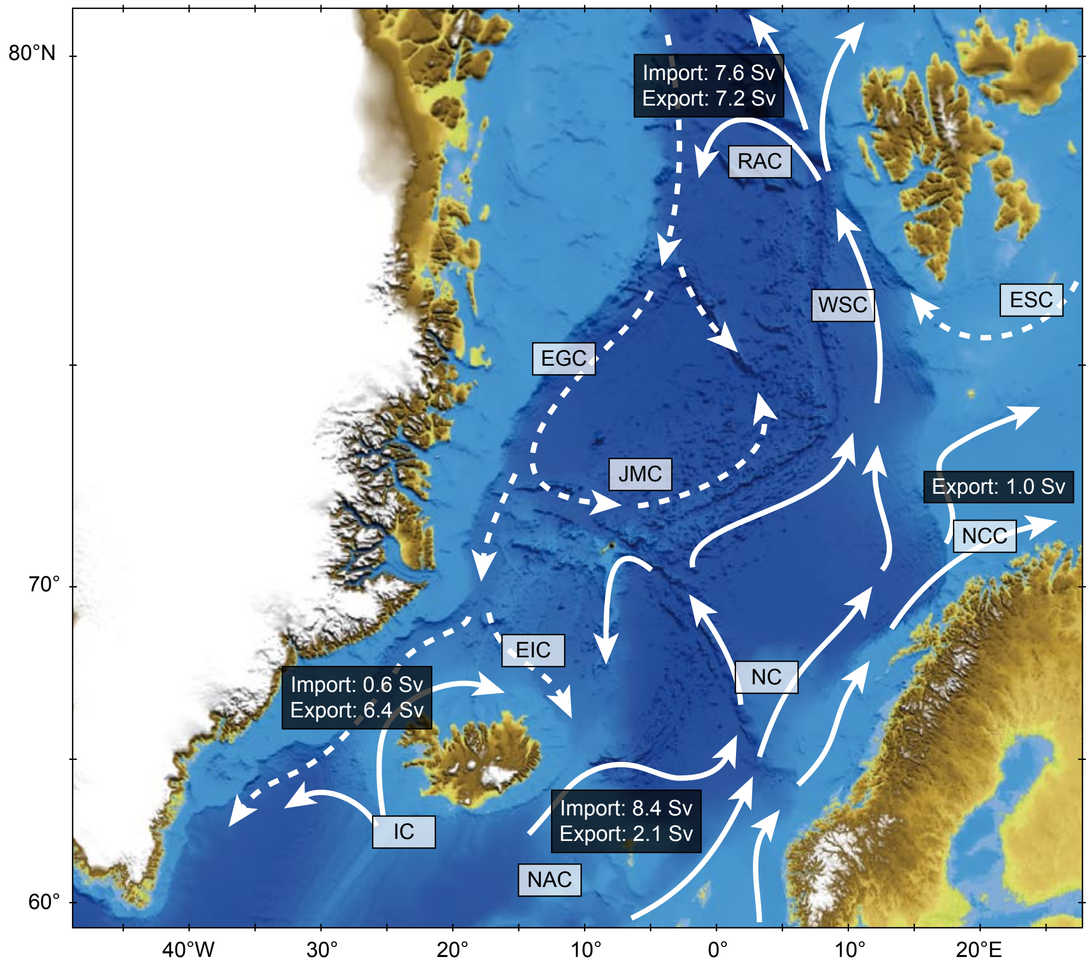


Figure 2.5 Main surface-current system of the Nordic Seas (modified after Hopkins, 1991; Blindheim and Østerhus, 2005). Import and export values indicate the volume budget of the water exchange between the Nordic Seas and the adjacent Arctic and Atlantic Ocean. For abbreviations see text. Dotted lines indicating cold surface currents, solid lines indicating warm surface currents.

The NAC transports relative warm (>4°C) and saline (>35 psu) Atlantic source waters (Johannessen, 1986; Swift, 1986; Hansen and Østerhus, 2000) to the north and enters the Nordic Seas across the Greenland-Scotland Ridge. The major part of the current flows through the Færœ-Shetland Trough, only a minor part crosses the Iceland-Færœ Ridge. Both branches flow northward along the Norwegian continental slope and form the Norwegian Current (NC). On the Norwegian shelf, the Norwegian Coastal Current runs parallel to the NC. As a branch of the NAC, the Irminger Current (IC) enters the Denmark Strait from the South and follows the coast of Iceland to the north-northeast. Off the Vøring Plateau, a branch of the NC splits off and circulates counter-clockwise towards Jan Mayen. North of Norway the NC splits into two branches. One part enters the Barents Sea and forms the North Cape Current (NCC). The main part of the NC remains in the Nordic Seas and is transported as the West Spitsbergen Current (WSC) further northward. The WSC is a complex branched current system, coupled to the topography. It follows the continental slope of the Bartens Sea and Spitsbergen northwards to the Fram Strait. Several branches, called Return Atlantic Currents (RAC), are deflected westward from the WSC: north of the Greenland Basin, north of the Boreas Basin and in the Fram Strait. Southwest of Spitsbergen the WSC converges with the East Spitsbergen Current (ESC), which transports colder and less saline Arctic Surface Water to the south. Therefore the water masses cool down, sink and enter in a subsurface current the Arctic Ocean. The EGC transports cold (<0°C) and less saline (<34.4 psu) Polar source waters (Swift and Aagaard, 1981; Bourke et al., 1987) and sea ice from the Arctic Ocean through Fram Strait into the Nordic Seas. The EGC follows the East Greenland continental margin southward and departs through Denmark Strait into the North Atlantic Ocean. Maximum current velocities of about 0.69 m/s occur over the slope (Bourke et al., 1987; Foldevik et al., 1988). Two branches, the Jan Mayen Current (JMC) and the East Icelandic Current (EIC), convey small amounts of Polar source waters counter-clockwise into the interior basins (Swift, 1986). In the region of the two counter-clockwise gyres the Polar and Atlantic source waters mix and form the Arctic waters with relative cold (0-4°C) and saline (34.4-34.9 psu) and therefore dense upper layer waters (Swift and Aagaard, 1981). These water masses play a significant role for the deep convection contributing to the formation of deep-water masses in the Nordic Seas (Dickson and Brown, 1994). The Atlantic, Arctic and Polar source waters are separated by steep oceanic fronts. These fronts are characterised by strong salinity and temperature gradients and they are called Arctic Front between Atlantic and Arctic water masses, and Polar Front between Arctic and

Polar water masses (Swift, 1986).

The Nordic Seas hold a crucial position within the oceanic conveyor belt (Broecker, 1997; 2000). The central Greenland Sea is considered as one of the most important sites for the renewal of North Atlantic Deep Water (NADW). The NADW ventilates the deep ocean and is an important part of the thermohaline circulation (Marshall and Schott, 1999). Different small-scale oceanographic processes like vertical convection in the open ocean caused by cooling of surface waters and production of dense brines on the shelves as a result of sea-ice formation, which then cascade across the continental margins into the adjacent deep-sea basins, lead to the formation of deep water (Tomczak and Dodfrey, 1994; Toggweiler and Key, 2001; Ivanov et al., 2004; Ronski and Budéus, 2005) (Figure 2.6). Deep-water masses from two different sources can be distinguished in the Nordic Seas. Greenland Sea Deep Water (GSDW) is formed during winter in the central Greenland Sea, where the cooling of surface waters causes intense vertical convection. The volume of the GSDW is increased by an inflow of Arctic Deep Water from the Arctic Ocean through the Fram Strait. The GSDW is the coldest (<-1.0°C) and least saline (34.908 psu) of the Nordic Seas deep-water masses. The Norwegian Sea Deep Water (NSDW) has the same salinity (34.908 psu) but it is slightly warmer (-1.0 to -0.7°C) (Aagaard et al., 1985; Oliver and Heywood, 2003). NSDW is a mixture of GSDW, which flows along fracture zones into the Lofoten and Norwegian basins and the waters, which are a result of downward cascading of brines on the northern and central Barents Sea shelf.

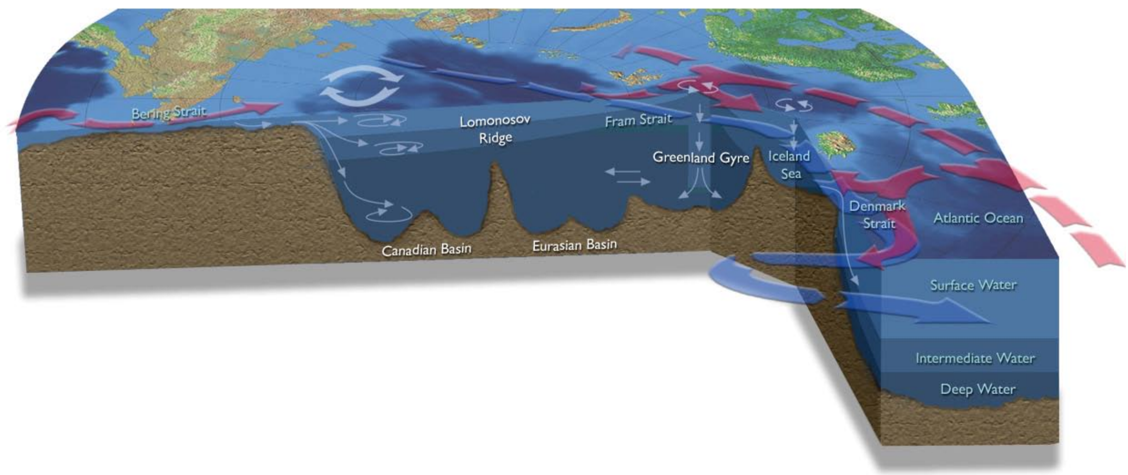


Figure 2.6 Cross section of the Arctic Thermohaline Circulation (ACIA, 2004). For further explanation see text.

The deep-water circulation in the Nordic Seas is, in contrast to the cyclonic surface circulation, strongly coupled to the topography. In general, the current velocities of the deep-water circulation are low (Aagaard and Carmack, 1989). The downward cascading of dense bottom waters from the shelves into the deep sea has an effect on the deep-water circulation. On the continental margin, numerous events with high current velocities and different flow directions occur. As a consequence of these events the circulation is marked by contourites and sediment drifts along the continental margin (e.g., Fohrmann et al., 2001). The cold and dense water masses formed in the Arctic Ocean and the Nordic Seas, enter the North Atlantic Ocean by crossing the Greenland-Scotland Ridge as deep overflows (Hansen and Østerhus, 2000). These overflow waters accelerate to current speeds of more than 1 m/s and with a total volume of approximately 8.5 Sv they contribute one-third of the total NADW production (Hopkins, 1991; Hansen et al., 2004). The main part of the overflow (~6.4 Sv) is exported from the Nordic Seas through the Denmark Strait. The overflow over the Iceland-Scotland Ridge is only of minor importance.

2.5 Ice Cover

Large areas of the Nordic Seas, especially of the Greenland Sea, are seasonally ice-covered (Figure 2.7). The ice cover shows a high seasonal, annual, and interannual variability in extent, thickness, and distribution. The maximum ice extent is observed at the end of February, the minimum in the middle of September (Ramseier et al., 2001; Divine and Dick, 2006). In general, the East Greenland continental margin is covered by ice from October to late June (Figure 2.8). In the Greenland Sea the ice extent as well as the marginal ice zone, the transition zone between the ice cover and the open ocean, is coupled with the Polar Front. The Greenland Sea ice regime is greatly affected by ice conditions in the Arctic Ocean as a result of the introduction of large volumes of ice through the Fram Strait (Vinje and Finnekåsa, 1986; Martin and Augstein, 2000; Kwok et al., 2004). Vinje et al. (1998) calculated an amount of approximately 2850 km^3 per year for the mean annual ice export from the Arctic Ocean into the Nordic Seas. The ice is transported parallel to the coast of East Greenland further southward in the EGC where a great part of the ice melts between 76 and 75°N (Martin and Wadhams, 1999). Some sea ice exits through the Denmark Strait into the North Atlantic Ocean. The large-scale ice cover plays a significant role in the environmental processes of the Nordic Seas as it influences the deep-water formation (Aagaard and Carmack, 1989; Marshall

Figure 2.7 Satellite image of the East Greenland continental margin from April 7th 2001 (NASA Visible Earth, 2005).

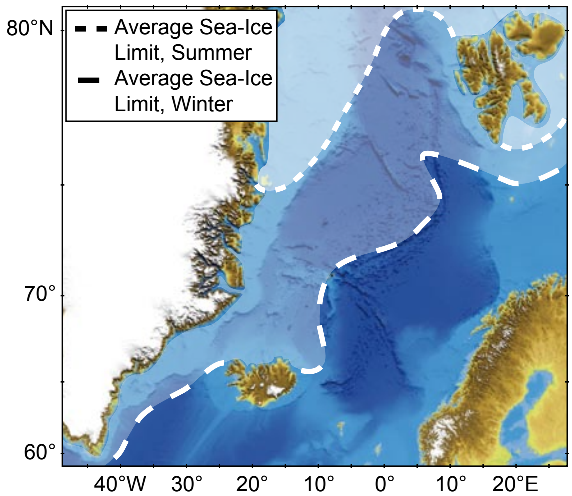


Figure 2.8 Average summer and winter sea-ice limit in the Nordic Seas (modified after Ramseier et al., 2001; Divine and Dick, 2006).

and Schott, 1999), the biological production and export (Peinert et al., 2001b; Sauter et al., 2001), and the sediment transport and deposition (Nürnberg et al., 1994; Ramseier et al., 1999).

The sea ice of the Greenland Sea mostly consists of multi-year pack ice originating from the Siberian continental shelf. It is interspersed with first-year ice or icebergs. The icebergs derive from fast-flowing outlet glaciers of the Greenland Ice Sheet (Dowdeswell et al., 1998). The main sources for icebergs within the EGC are major fjord systems in Northeast and East Greenland (e.g., Independence Fjord, Hagen Fjord, Kejser Franz Joseph Fjord, Kong Oscar Fjord, Scoresby Sund). Along the northern portion of the Greenland coast, the discharged icebergs are often grounded, or trapped, so that the fjord systems further south are more important for the supply of icebergs into the Nordic Seas (Hopkins, 1991; Dowdeswell et al., 1993; Dowdeswell et al., 1998). At the north coast of Greenland landfast ice can develop (Wadhams, 1986). The multi-year sea ice, which is formed on the shallow Siberian shelf regions by different processes, drifts with the Transpolar Drift to the Fram Strait where it enters the Nordic Seas. The average time sea ice from different locations in the Arctic Ocean need to reach the Fram Strait varies from 6 years for ice from the southern Beaufort Sea to 1 year for ice from north of Svalbard (Pfirman et al., 1997). Micropaleontological and sedimentological investigations of sea-ice sediments show that the Laptev Sea is the most important source area for multi-year sea ice of the Fram Strait and the Nordic Seas (Abelmann, 1992; Nürnberg et al., 1994; Dethleff et al., 2000; Eicken et al., 2000; Dethleff, 2005) (Figure 2.9). The average thickness of multi-year ice in the Fram Strait is only 3.27 m (Vinje et al., 1998). During winter months there is a significant formation of first-year ice, mainly in the 'Is-Odden'-region (Wadhams, 1986; Ramseier et al., 2001). The first-year ice has a thickness between 0.2 and 2 m. The ice peninsula, which is related to the JMC is primarily made up of first-year ice and only small amounts of multi-year ice carried southward by the EGC, are incorporated (Toudal, 1999). This region shows the greatest annual and interannual sea-ice variability in the Nordic Seas. In winter and spring, sites of open waters, called polynyas, occur in certain well-defined areas within the ice covering the East Greenland continental margin. These polynyas are produced by various mechanisms, persist for days or weeks, and are able to open and close repeatedly (Wadhams, 1986).

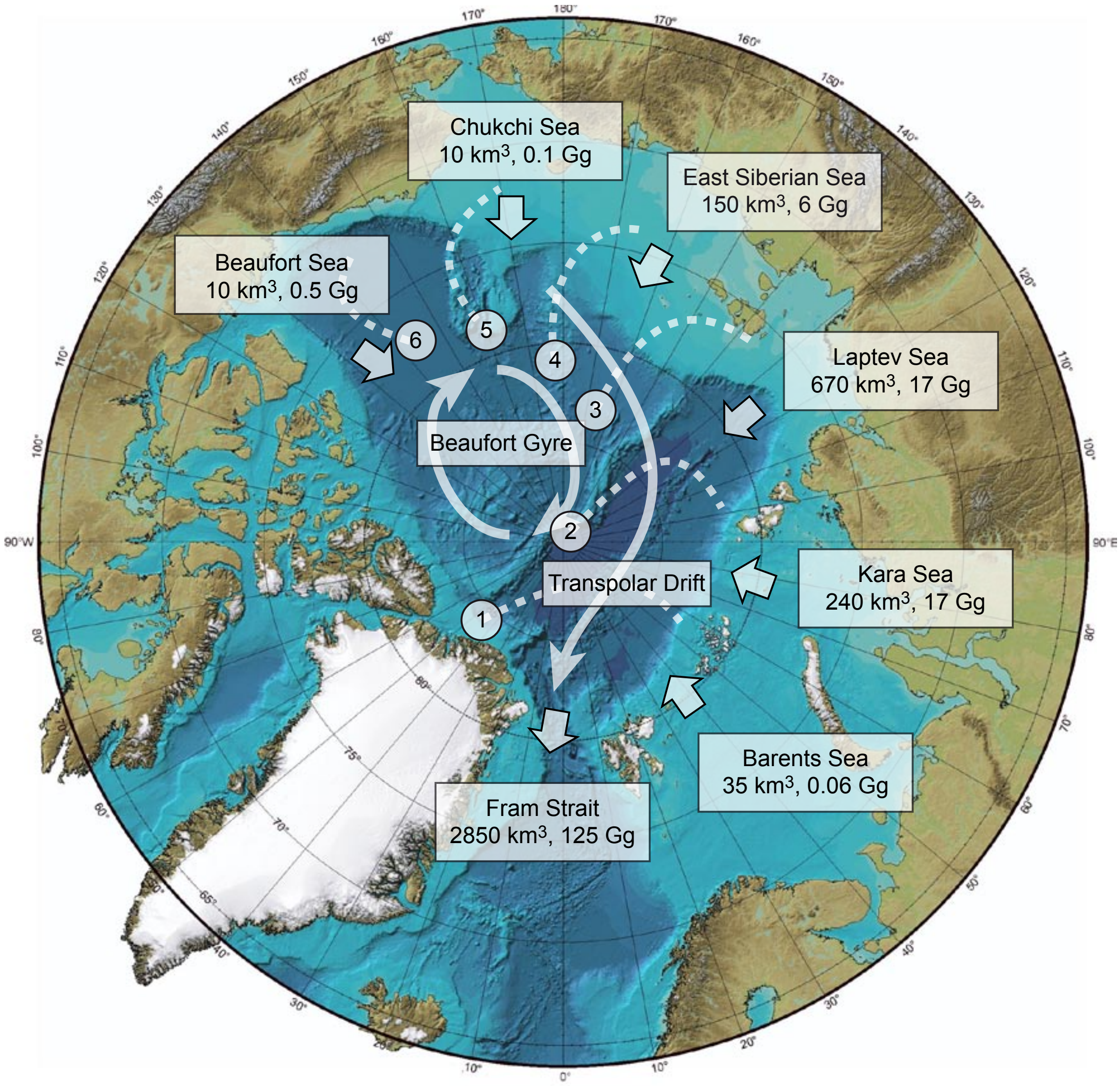


Figure 2.9 Mean field of ice drift in the Arctic Ocean. Numbered lines indicate the average number of years required for ice in this location to exit the Arctic Ocean through Fram Strait. Boxes include the net annual export of sea ice and associated transport of terrigenous particulate organic matter from the marginal seas into the Arctic Ocean and through Fram Strait into the Nordic Seas (modified after Pfirman et al., 1997; Eicken, 2004).

2.6 Production and Export

Marine production in the Nordic Seas is based primarily on phytoplankton in the water column and microalgae associated with sea ice. The carbon fixed in primary production passes in three directions. These are (1) to herbivorous zooplankton and through a sequence of higher trophic levels to higher animals; (2) to the microbial loop; and (3) through vertical flux to the benthos (Clarke, 2001; Carroll and Carroll, 2003; Sakshaug, 2004) (Figure 2.10). Only a small portion of the primary production is exported to the sea floor and finally transferred into the sedimentary record (Berger et al., 1989; Bruland et al., 1989; Jumars et al., 1989).

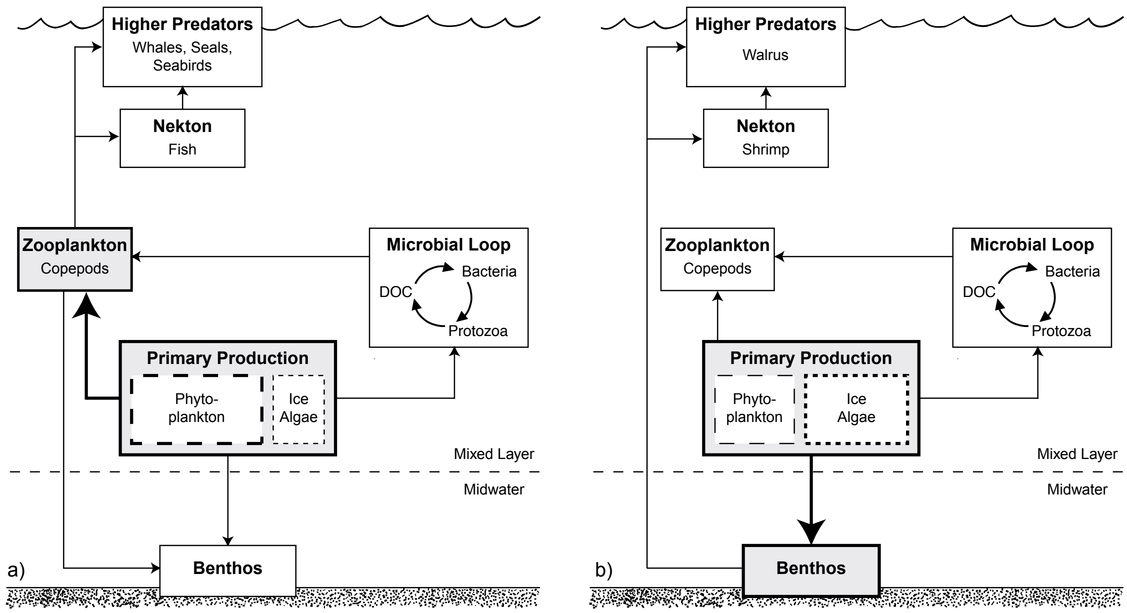


Figure 2.10 Idealised scheme for the Nordic Seas describing two primary-production scenarios related to ice cover, and their trophic implications. **a)** Primary production dominated by phytoplankton under limited ice conditions. **b)** Primary production dominated by ice algae under abundant ice conditions. Thicker arrows and boxes signify primary organic carbon flows, DOC = dissolved organic carbon (modified after Clarke, 2001; Carroll and Carroll, 2003).

2.6.1 Primary Production

Primary producers in the Nordic Seas include phytoplankton, ice algae, and benthic microalgae and macrophytes. The ice cover strongly influences the primary production and according to Carroll and Carroll (2003) two different food-web scenarios are distinguished (Figure 2.10). Beneath the predominant primary production by phytoplankton the production by ice algae is the most important factor to be considered whereas the production by benthic organisms is negligible (Aagaard et al., 1999). The primary production of the Nordic Seas ecosystem is characterised by strong seasonal cycles driven by the availability of light and nutrients (Carroll and Carroll, 2003). Changes in the availability of light and nutrients are mainly controlled by sea ice. Therefore the primary production before April and after August is argued to be negligible (Richardson et al., 2005; Sanders et al., 2005). The phytoplankton growth in the Greenland Sea starts in early May and develops through May reaching a peak in early June. The summer situation is characterised by strong stratification and an upper mixed layer of about 30 m that become completely depleted of nutrients and contain low phytoplankton biomass in August (Rey et al., 2000). The marginal ice zone is characterised by highly variable physical and biological conditions, which foster an enhanced local primary production (Peinert et al., 2001b) (Figure 2.11). The ice-related primary production consists of actively growing phytoplankton at the outer edge of the ice margin and in larger leads, a layer of specialised sub-ice algal assemblages in pack ice, and a sub-ice algal assemblage associated with multi-year ice (Falk-Petersen et al., 2000; Carroll and Carroll, 2003). The phytoplankton as well as the ice-algal communities commonly consist of diatoms (as the most abundant species in both), chrysophytes, dinophytes (dinoflagellates), prymnesiophytes, and green flagellates (Gradinger et al., 1999; Sakshaug, 2004; Mock and Thomas, 2005). In general, the Arctic ice-algal communities are characterised by the marine planktic diatom *Melosira arctica* and the marine benthic diatom *Nitzschia frigida* (Abelmann, 1992; Falk-Petersen et al., 1998; Henderson et al., 1998).

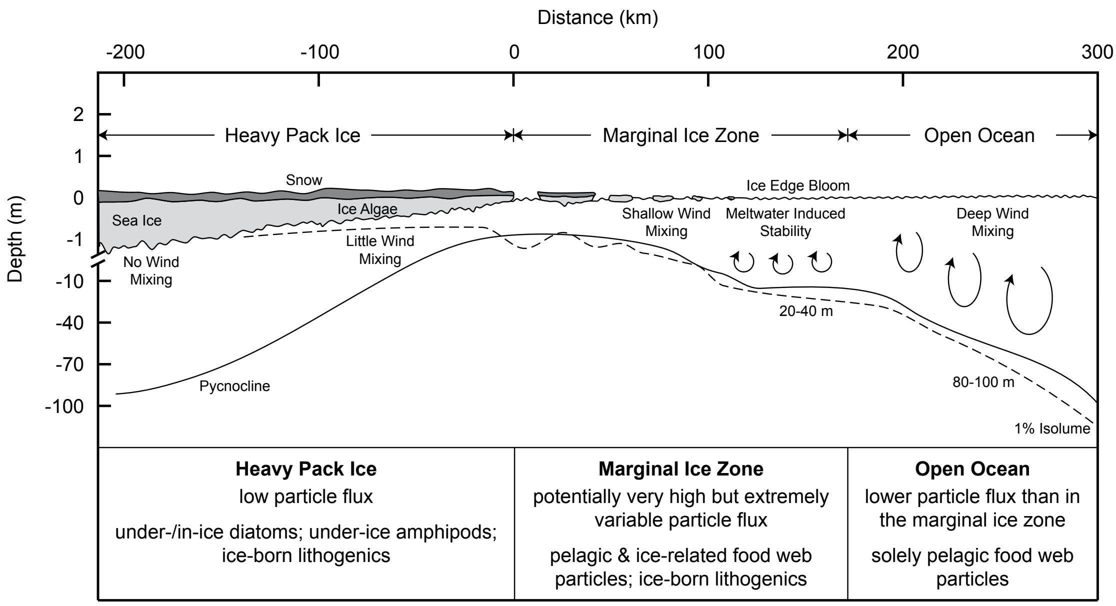


Figure 2.11 Schematic model of ice-related and pelagic particle sources for vertical flux in the seasonally ice-covered Greenland Sea (modified after Sullivan et al., 1988; Peinert et al., 2001b).

In the permanently ice-free parts of the Nordic Seas (i.e., Norwegian and Iceland Sea) the annual primary production is higher than in the seasonal ice-covered parts (i.e., Greenland Sea). According to the compilation of Sakshaug (2004) in the Norwegian Sea and Iceland Sea the annual primary production reaches values of 80 to 150 g C/m^2 and 100 to 200 g C/m^2, respectively, whereas for the Greenland Sea a value of 81 g C/m^2 is estimated by Richardson et al. (2005).

2.6.2 Secondary Production

Secondary producers like herbivorous mesozooplankton, bacteria, and benthic organisms remove the produced phytoplankton biomass, transferring it up through the grazing food chain to fish and higher animals (Sakshaug, 2004). Thereby many secondary producers convert plant carbon into storage products (i.e., lipids) (Sargent and Henderson, 1986; Kattner and Hagen, 1995; Graeve et al., 1997). The occurrence and distribution of sea ice has an important effect on secondary production. The pronounced seasonality of sea ice causes seasonal variations in composition and abundance of sea-ice fauna and controls the food-web structure (Loeng et al., 2005; Werner, 2006). Under limited ice conditions, zooplankton grazers that are tightly coupled to phytoplankton blooms, can drive a food web towards fish production, whereas the absence of such grazers under abundant ice conditions leads to benthic-pelagic coupling and a food web dominated by benthos (Wassmann et al., 1996; Aagaard et al., 1999) (Figure 2.10). Copepods dominate the mesozooplankton with 70 to 90% of the biomass. Additionally amphipods, herbivorous krill and pteropods occur in smaller abundances (Ashjian et al., 1997; Falk-Petersen et al., 1999a; Sakshaug, 2004). Benthic organisms like foraminifera, nematodes and copepods are among the community of secondary producers, and especially under abundant ice conditions they are a significant source for secondary production. The benthos highly depends on the seasonal export of organic material provided by the spring bloom, which follows the retreating ice edge or is associated with polynyas (Carroll and Carroll, 2003; Schewe and Soltwedel, 2003; Piepenburg, 2005). Bacteria are the third important group of secondary producers in sea ice as well as in marine sediments (Gradinger et al., 1999; Quéric et al., 2004; Soltwedel et al., 2005). They form an essential part of the microbial loop as they remineralise the dissolved organic carbon (DOC) and they produce biomass, which is consumed by higher secondary producers (Landry, 2001). In comparison to the phytoplankton biomass, the biomass of zooplankton is negligible but the biomass of bacteria is of great importance. Gradinger et al. (1999) showed that the bacteria biomass contributes with 31% the largest fraction of organic carbon in sea ice.

2.6.3 Export Fluxes and Remineralisation

A part of the primary produced organic material is exported as particulate organic matter (POM) from the surface waters through the water column to the deep sea. The POM represents the main food source for benthic organisms. Large, rapidly sinking particles like faecal pellets and marine snow are responsible for the majority of the downward vertical transport of organic matter (Bruland et al., 1989; Alldredge, 2001). Both types of rapidly sinking particles are produced from smaller particles. Faecal pellets, large enough to sink rapidly, are produced by larger zooplankton (e.g., large copepods, amphipods, and chaetognaths) via biologically mediated aggregation of consumed small particles. Marine snow consists of aggregates of highly diverse origins, structures, and characteristics that are larger than 0.5 mm in diameter. It includes fragile, porous, loose associations of smaller particles, highly cohesive, robust gelatinous webs produced by zooplankton, and some flocculent, porous faecal pellets. The aggregation of marine snow occurs through physically mediated processes of collision and sticking (Alldredge, 2001; Lampitt, 2001).

The export of biogenic particles is controlled by surface circulation, deep-winter convection, eddy fields and, in a prominent manner, sea-ice dynamics, and therefore it correlates with the different water masses of the Nordic Seas (i.e., Polar, Arctic and Atlantic waters) (von Bodungen et al. 1995; Peinert et al., 2001a; Sauter et al., 2001; Bauerfeind et al., 2005). As a consequence, the fluxes of organic matter determined in Atlantic waters of the ice-free Norwegian continental slope are generally higher than those determined in Polar waters of the seasonally ice-covered East Greenland slope in comparable water depth (Schlüter et al., 2000; Sauter et al., 2001). Also the composition of the exported particles varies between the water masses. In Atlantic waters more calcareous matter is exported whereas in Polar waters the export of siliceous particles is dominant (Peinert et al., 2001a). The fluxes of organic matter generally decrease towards greater water depths and according to Schlüter et al. (2000) only 1.7 to 1.8% of the primary production is transferred to the sea floor of the deep basins of the Greenland and Norwegian Seas whereas approximately 3.3% of the primary production reaches the sea floor of the Iceland Plateau. More than 95% of the exported organic carbon is remineralised at the sediment-water interface and the main portion of the organic carbon degradation takes place within the uppermost millimetres of the sediment (Schäfer-Pinto, 1999; Schlüter et al., 2000; Sauter et al., 2001).

2.7 Transport and Sedimentation Processes

Previous investigations of the transport and sedimentation processes in the Nordic Seas have shown that different modes have to be considered. The particle transport by sea ice or icebergs, ocean currents, and gravity-driven mass movements at continental margins are the most significant factors (Wollenburg, 1993; Fohrmann et al., 2001; Rumohr et al., 2001; Eicken, 2004; Stein and Macdonald, 2004b). In contrast to the Arctic Ocean, where the fluvial input and the input through coastal erosion are responsible for the major part of the sediment supply (Rachold et al., 2004), these factors are only of minor importance in the Nordic Seas. The aeolian sediment supply to the Nordic Seas is negligible.

According to Stein and Macdonald (2004b) 8 Mt/a sediment get exported by sea ice through the Fram Strait. Measured sea-ice sediment concentrations in sea ice of the Fram Strait and the Greenland Sea reach maximal values of 600 mg/l (Wollenburg, 1993). Generally, the sediments show a consistent grain-size distribution and are classified as silty clays or clayey silts (Pfirman et al., 1990; Wollenburg, 1993; Nürnberg et al., 1994). Coarse sediments and stones occur in these sediments as ice-rafted debris (IRD) (Nürnberg et al., 1994). Different mechanisms, like suspension freezing, anchor ice formation, deposition of river sediments onto a flooded fast ice cover, and aeolian deposition, must be considered for the sediment entrainment in sea ice (Wollenburg, 1993; Lisitzin, 2002; Eicken, 2004; Dethleff, 2005). The incorporated sediments consist approximately by two-thirds of terrigenous and one-third of biogenous matter. The terrigenous matter is characterised by clay minerals, quartz and feldspar (Nürnberg et al., 1994). The biogenous part mainly consists of marine diatoms and to a minor part of marine planktic tintinnids, silicoflagellates, copepods, radiolarians, dinocysts, pelecypods and amphipods (Abelmann, 1992; Falk-Petersen et al., 1998; Henderson et al., 1998). Higher-plant fragments (i.e., logs and bark) has also been observed (Nürnberg et al., 1994; own observations). The content of total organic carbon (TOC) in Arctic sea-ice sediments is relatively high and varies between 0.6 and 6.4 wt.-% whereas the amount of calcium carbonate is relatively low with a maximum value of 2 wt.-% (Wollenburg, 1993; Nürnberg et al., 1994; Stein et al., 1994; this study). In consequence of the melting sea ice, which takes place in the corridor of the East Greenland Current during the whole year, it leads to a release of the incorporated terrigenous and biogenous particles (Ramseier et al., 2001). The processes occurring during melting and particle release are delineated by Pfirman et al. (1990), Freitag (1999) and Ramseier et al. (2001). Of great importance for the sedimentation of sea-ice sediments is the cryoconite formation, which results in aggregation of particles in the base of cylindrical holes in the ice surface (Pfirman et al., 1989). Thereby more or less cohesive pellets with a diameter of up to 5 cm may develop. When released, these pellets may settle intact to the sea floor (Pfirman et al., 1990; Wollenburg, 1993; Freitag, 1999).

In addition to the sediment transport by sea ice, lateral transport processes like gravity-driven mass movements including slides, debris flows, and turbidity currents and ocean current controlled sediment transportation are to consider as the most important transportation processes of particles in the Nordic Seas (Henrich, 1990; Vorren et al., 1998; Fohrmann et al., 2001; Rumohr et al., 2001) (Figure 2.12). Today, the East Greenland fjord systems and the inner shelf act as sinks and the sediments from the hinterland get deposited in these areas (Evans et al., 2002; Smith et al., 2002). There is no transport of material from the inner shelf towards the deep sea (Dowdeswell et al., 1994; Evans et al., 2002; Soltwedel et al., 2005). During glacials, the sediment transport across the East Greenland continental margin generally occured along channel systems (e.g., Ardencaple Channel System). These channel systems begin on the continental shelf and are traced down to the deep sea where they run out in large deep sea fans. The sediment transport was mainly carried out by episodically turbidity

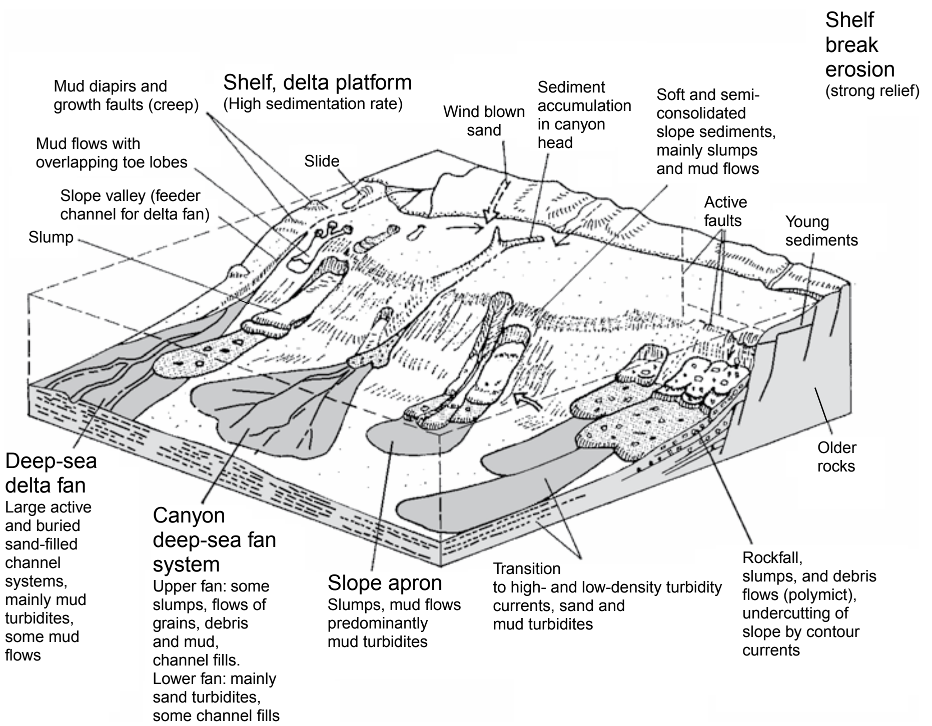


Figure 2.12 Summary diagram of sedimentary features and transport mechanisms typical of continental margins (Einsele, 1991).

currents and debris flows (Ó Cofaigh et al., 2004). Slides are a characteristic feature of the gravity-driven mass movements on the Norwegian continental margin but play no significant role on the East Greenland continental margin (Vorren et al., 1998; Rumohr et al., 2001). Large-scale ocean current controlled sediment transport is generally linked to nepheloid layers. Two types of nepheloid layers are distinguished. The bottom nepheloid layer (BNL) is a feature of the deepest part of the water column and it reaches a maximum thickness between 500 and 1500 m. Another class of nepheloid layers found especially at continental margins comprise intermediate nepheloid layers (INL). These layers occur frequently at high levels off the upper slope and at the depth of the shelf edge (McCave, 2001). The nepheloid layers of both types are principally produced by resuspension of bottom sediments caused by strong ocean currents. In general, the highest particle load appears in regions of deep western boundary currents, in regions of recirculation and in regions of high surface eddy kinetic energy located over strong thermohaline bottom currents. The lateral advection in nepheloid layers takes place along isopycnal surfaces. The detachment occurs where these isopycnals intersect the bottom caused by steep topography or caused by sloping isopycnals (McCave, 2001). The total amount of sediment export by ocean currents from the Arctic Ocean through the Fram Strait into the Nordic Seas is estimated to reach about 52 Mt/a (Stein and Macdonald, 2004b). Figure 2.13 shows a summary diagram of important factors controlling the sediment supply and distribution on the East Greenland continental margin.

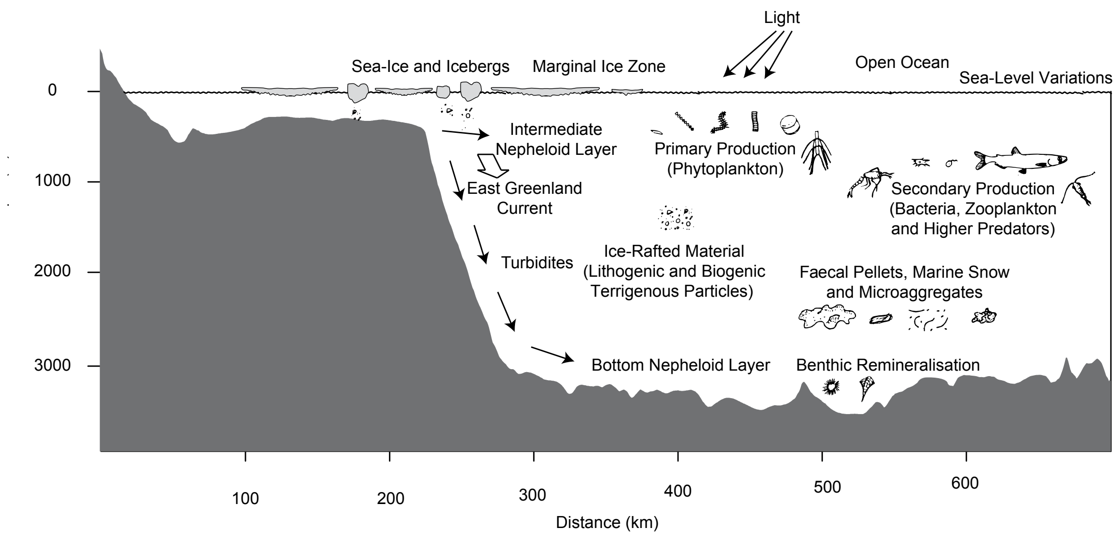


Figure 2.13 Summary diagram of important factors controlling the sediment supply and distribution on the East Greenland continental margin (modified after Nam et al., 1995).

3 Organic Matter in Marine Sediments

The organic-carbon content of sedimentary records range from zero up to almost 100% in coals. In freshly deposited marine sediments organic-carbon content rarely exceeds 2% and over most of the ocean floor it is <0.25% (Pedersen and Calvert, 1990). The deposition of organic matter was not continuously throughout geological times, and to understand the reasons for its variations in deposition it is necessary to examine the production and fate of organic material in present-day environments (Killops and Killops, 2005). With the knowledge of the present-day processes controlling the sedimentation of organic carbon and the organic-carbon record in sediment cores it is possible to estimate the importance and variability of the processes during geological times and to reconstruct paleoenvironmental conditions. Several organic-geochemical bulk parameters like the carbon/nitrogen (C/N)-ratio and the Rock-Eval Pyrolysis parameters are relatively reliable proxies to distinguish between aquatic and terrigenous origin of the organic material in sediments (Meyers, 1997; Stein and Macdonald, 2004a). It has to be taken into consideration that the term aquatic includes as well the marine as the limnic and the fluviatile environment. A more detailed characterisation of the organic matter and its assignment to specific biological sources can be obtained from the extractable organic matter by biomarkers (*n*-alkanes, fatty acids, sterols, *n*-alcohols) and their stable carbon isotope ratios (e.g., Yunker et al., 1995; Meyers, 1997; Fahl and Stein, 1999; Birgel et al., 2004).

3.1 Organic-Geochemical Bulk Parameters

3.1.1 Carbon/Nitrogen (C/N)-Ratios

The weight ratios of total organic carbon (TOC) to total organic nitrogen are often used to distinguish between aquatic (i.e. phytoplankton and zooplankton) and terrigenous (i.e., higher plant) organic matter in marine sediments (Müller, 1977; Meyers, 1997; Schubert and Calvert, 2001; Stein and Macdonald, 2004a; Lamb et al. 2006). Proteins are the main nitrogen compounds of living organisms. Animals and plants, which are rich in protein, show low C/N-ratios (phytoplankton and zooplankton) whereas organisms with protein content less than 20% show high C/N-ratios (higher plants). The mean C/N-ratio of marine phytoplankton and zooplankton is 6.0 and 5.4, respectively (Müller, 1977). Due to a preferential decomposition of protein-rich components in the water column the C/N-ratios of marine organic matter may increase with increasing water depth to values around 10 (Müller, 1977; Stein, 1991). Terrigenous organic matter (TOM) is characterised by C/N-ratios of more than 15 and it can reach values of about 200 (Bordovskiy, 1965; Hollerbach, 1985; Stein, 1991) (Figure 3.1). It has to be taken into account, that due to technical reasons the C/N-ratios of sediments are commonly calculated from the total organic carbon and total nitrogen contents. The measured total nitrogen is a mixture of organic nitrogen derived from organisms and of inorganic nitrogen, which is mainly coupled to clay minerals. In general, inorganic nitrogen concentrations are small in comparison to those of organic nitrogen (Stein and Macdonald, 2004a). However, in conjunction with low total organic carbon contents (<0.5 wt.-%) the inorganic nitrogen could be a prominent part of the measured total nitrogen and undervalued C/N-ratios occurr. The inorganic nitrogen is fixed as ammonium ions in clay minerals, especially in the clay minerals illite and vermiculite (Müller, 1977).

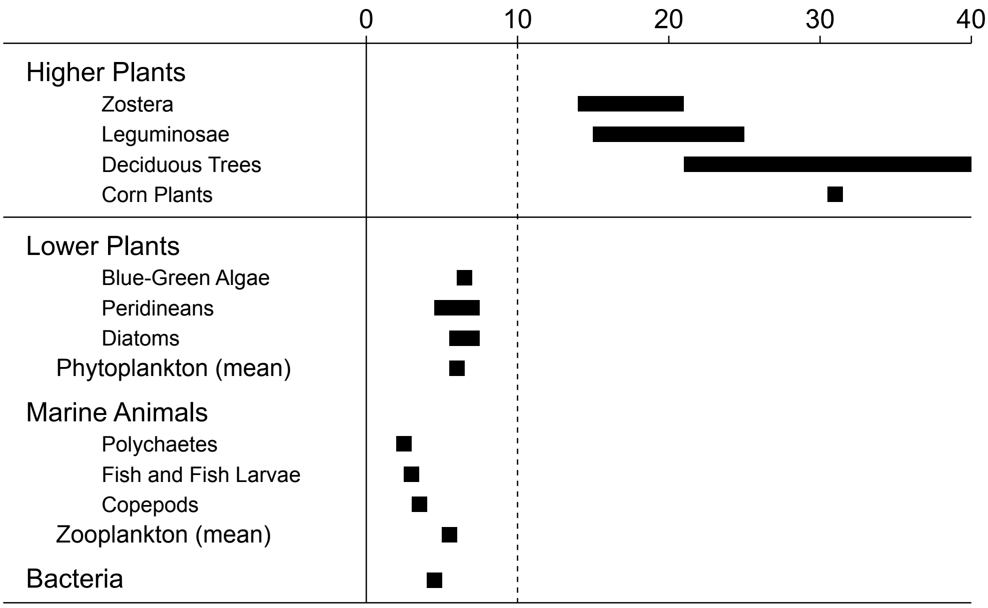


Figure 3.1 Carbon/nitrogen (C/N)-ratios of marine and terrestrial organisms (modified after Bordovskiy, 1965; Müller, 1977; Hollerbach, 1985).

With the use of a diagram including TOC versus total nitrogen it is possible to estimate the inorganic nitrogen concentration in sediment samples. Thereby the positive intercept of the regression line represents the amount of inorganic nitrogen (Ruttenberg and Goñi, 1997; Schubert and Calvert, 2001; Stein and Macdonald, 2004a). After a correction for the inorganic proportion of nitrogen, the C/N-ratios increase and a more reliable interpretation is possible.

3.1.2 Rock-Eval Pyrolysis Parameters

Another useful method to characterise the organic material in immature sediments is the Rock-Eval Pyrolysis method after Espitalié et al. (1977) (see Chapter 4.2 for method details). The hydrogen index (HI) and the oxygen index (OI) are used to distinguish between different kerogen types and to appraise the maturity of the organic material. Immature organic material is classified into kerogen type I to III (Tissot and Welte, 1984). Occasionally a kerogen type IV is recognised (Killops and Killops, 2005). Kerogen types I and II are of aquatic origin. Kerogen type I is characterised by shallow-water (lacustrine or marine) algal material and kerogen type II is a mixture of marine phyto- and zooplankton material. Immature samples of both kerogen types show high HI values between 300 and 800 mg HC/g TOC and low OI values less than 100 mg CO_2/g TOC. Kerogen type III usually consists of reworked higher-plant debris. In contrast to the high HI and the low OI values of kerogen types I and II, the kerogen type III shows low HI values about 100 mg HC/g TOC and high OI values above 100 mg CO_2/g TOC. Kerogen type IV comprises refractory terrigenous organic matter without any hydrocarbon-generating potential. It is characterised by extremely low HI and OI values. To illustrate the results, HI and OI are plotted in van Krevelen-type diagrams. In this type of diagram the HI and OI values converge to the point of origin with increasing maturity (Figure 3.2a). The standardised parameter T_{max} represents the temperature at which the maximum of the generated volatiles are measured and is used as an indicator of the maturity of the kerogen. Immature organic material has T_{max} values of less than 435°C. A HI

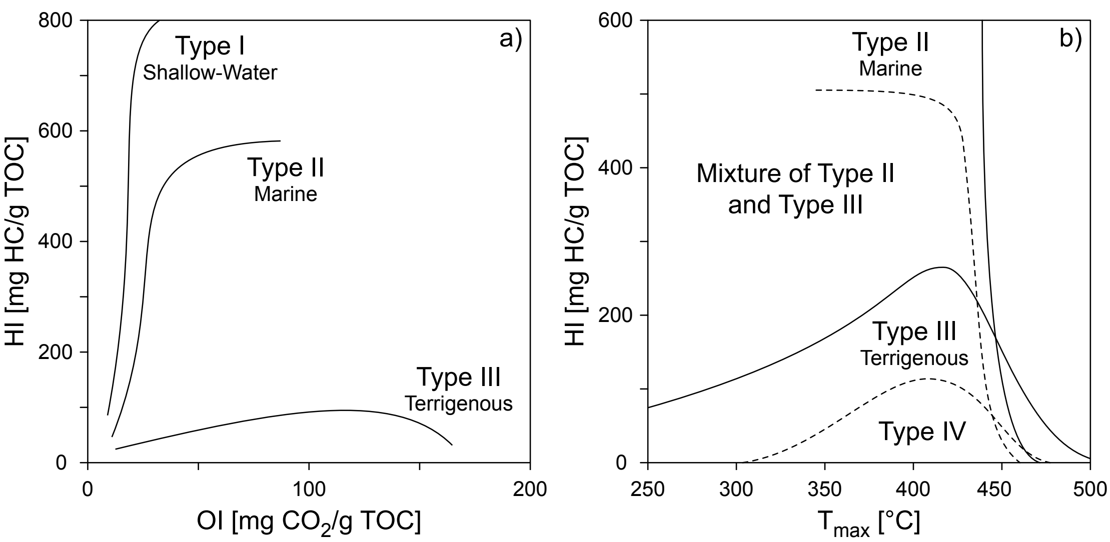


Figure 3.2 a) Van Krevelen-type diagram for plots of HI versus OI with maturity paths of different kerogen types. **b)** Diagram for plots of HI versus T_{max} with sectors of different kerogen types (modified after Tissot and Welte, 1984; Cornford et al., 1998)

versus T_{max} diagram give further information about the composition of the organic matter (Cornford et al., 1998; Stein and Macdonald, 2004a) (Figure 3.2b). For the interpretation of the data it must be kept in mind that for clay-rich rocks containing less than 0.5% TOC, HI values are likely to be to low and T_{max} to high because of absorption of pyrolytic organic compounds onto the mineral matrix ("mineral matrix effect") (Espitalié et al., 1980; Peters, 1986).

When using HI and OI it has to be considered that the Rock-Eval Pyrolysis method was originally established for hydrocarbon source rock characterisation, but it also has become a standard method for the fast characterisation of organic carbon in young, immature sediments (e.g., Stein, 1991; Wagner and Dupont, 1999; Stein and Macdonald, 2004a; Knies, 2005). To account for the immature organic carbon in young sediments it appears necessary to add the Rock-Eval yield of free hydrocarbons (S1 value) to the pyrolysates (S2 value) before calculating a modified HI (HI(S1+S2)) (Dean et al., 1994; Wagner and Dupont, 1999; Knies, 2005). Using a genetic potential (S1+S2) versus TOC diagram allows determining the refractory or 'dead carbon' content. The positive intercept of the regression line predicts the average content of the 'dead carbon' organic matter that does not contribute to the pyrolysate yield. For the interpretation of the Rock-Eval data it is reasonable to subtract the 'dead carbon' from the TOC and to calculate another modified HI (HI(S1+S2)') (Langford and Blanc-Valleron, 1990; Cornford et al., 1998; Knies, 2005).

3.2 Biomarker Composition

The sedimentary organic matter is mainly composed of kerogen, which is insoluble in organic solvents. The smaller amount of the organic matter, which is soluble in organic solvents, is termed bitumen. The bitumen comprises some fragments of polymetric material (asphaltenes and resins) and some free (i.e., not chemically bound to kerogen), relatively small molecules that are mainly hydrocarbons of lipid origin (aliphatics and aromatics). Some of them are used as biomarkers (Tissot and Welte, 1984; Killops and Killops, 2005) (Figure 3.3). Biomarkers (other synonyms being geochemical fossils and biological marker compounds) are organic compounds found within sediments and they can be unambiguously linked with biological precursor compounds, owing to the preservation of their basic skeletons in recognisable form throughout diagenesis. Many biomarkers originally possess oxygen-containing functional groups and undergo the same defunctionalisation processes as the bulk of the organic matter. Therefore, the diagenetic products are hydrocarbons and in smaller amounts functionalised components. In addition, unsaturated compounds tend to become reduced (Brassell, 1993; Brocks and Summons, 2004; Killops and Killops, 2005). Although the amount of specific biomarkers in sediments is low (Figure 3.3), they enable detailed information about the composition of organic matter and they are useful parameters to classify sources and different depositional environments (e.g., Tissot and Welte, 1984; Poynter and Eglinton, 1991; Meyers, 1997; Volkman et al., 1998; Brocks and Summons, 2004; Killops and Killops, 2005).

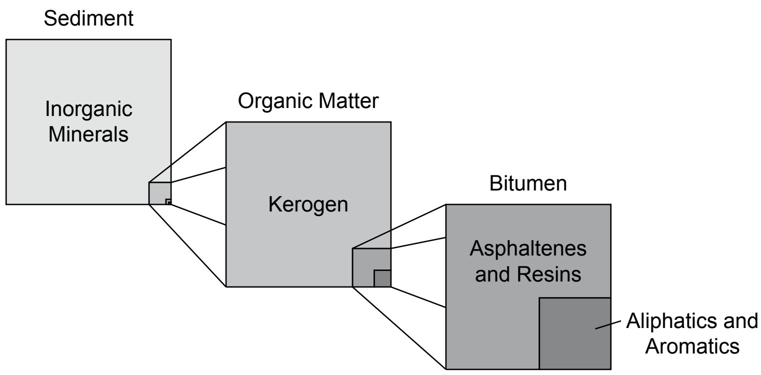


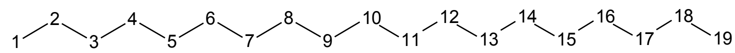
Figure 3.3 Composition of sediment, organic matter and bitumen (modified after Killops and Killops, 2005).

In recent sediments, biomarker distributions are usually used to distinguish between contributions from major groups of organisms (e.g., bacteria, phytoplankton, zooplankton, higher plants). This is because specific biomarkers are exclusive to a specific group of organisms. Additional information about the sources of the organic material is obtained by stable carbon isotope investigations of specific biomarkers (Hayes et al., 1990). With the knowledge of the sources of the organic matter it is possible to reconstruct (paleo-) surface water productivity and to estimate the relevance of lateral and vertical transport processes in the water column (e.g., Yunker et al., 1995; Fahl and Stein, 1999; Goñi et al., 2000; Belicka et al., 2002; Birgel et al., 2004).

In this study, the variability and distribution of different lipids are investigated. Lipids are defined as all those substances produced by organisms that are effectively insoluble in water but extractable by solvents which dissolve fats. This definition encompasses a variety of compound classes, including glycerides (e.g., fatty acids), waxes and related compounds (e.g., *n*-alkanes, *n*-alcohols) and terpenoids (e.g., sterols).

3.2.1 *n*-Alkanes

Normal alkanes (*n*-alkanes) are saturated hydrocarbons with a straight-chain structure (Figure 3.4). They result from the decarboxylation of fatty acids and therefore exhibit a corresponding odd-over-even predominance (Killops and Killops, 2005) (Figure 3.5). As a consequence of their susceptibility to biodegradation, they only occur in small amounts in sediments. Nevertheless, they are important biomarkers and they are used to characterise the organic carbon (Madureira et al., 1995; Meyers, 1997; Schubert and Stein, 1997; Belicka et al., 2002; Birgel et al., 2004).



n-C_{19} nonadecan

Figure 3.4 Chemical structure and numbering convention of *n*-alkanes considering as example nonadecan.

$$\underset{\text{acid}}{CH_3(CH_2)_nCH_2COOH} \longrightarrow \underset{\text{alkane}}{CH_3(CH_2)_nCH_3} + \underset{\text{carbon dioxide}}{CO_2}$$

Figure 3.5 Reaction equation of acid decarboxylation resulting in alkane formation.

High concentrations of short-chain *n*-alkanes with carbon numbers <20 occur in marine phytoplankton. In this case the *n*-alkanes range from C_{13} to C_{20} with a predominace of odd-carbon chain lengths and a concentration maximum at C_{15}, C_{17}, or C_{19} (Gelpi et al., 1970; Blumer et al., 1971; Youngblood and Blumer, 1973). These compounds may also be synthesised by freshwater algae (Eglinton and Hamilton, 1963; Venkatesan et al., 1987; Fahl and Stein, 1999) but their contribution to the sum of *n*-alkanes in marine sediments is negligible and short-chain *n*-alkanes are used as a marker for marine organic matter source due to algal input (Yunker et al., 1995; Fahl and Stein, 1997; Schubert and Stein, 1997).

Long-chain *n*-alkanes with more than 23 carbon atoms are abundant in epicuticular waxes of higher plants and they show an odd-over-even predominance in carbon-chain lengths with a maximum at C_{27}, C_{29}, and C_{31} (Eglinton et al., 1962; Eglinton and Hamilton, 1967; Kunst and Samuels, 2003; Bi et al., 2005). The production of long-chain *n*-alkanes by some special sulfate-reducing bacteria is negligible (Davis, 1968). Consequently, the long-chain *n*-alkanes C_{27}, C_{29}, and C_{31} are used as an indicator for the supply of TOM into marine sediments (Prahl and Muehlhausen, 1989; Yunker et al., 1995; Schubert and Stein, 1997; Fahl et al., 2003; Birgel et al., 2004).

The carbon preference index (CPI, Bray and Evans, 1961) is a numerical means of representing the odd-over-even predominance in long-chain *n*-alkanes:

$$CPI = \frac{1}{2} x \frac{C_{25}+C_{27}+C_{29}+C_{31}+C_{33}}{C_{24}+C_{26}+C_{28}+C_{30}+C_{32}} + \frac{1}{2} x \frac{C_{25}+C_{27}+C_{29}+C_{31}+C_{33}}{C_{26}+C_{28}+C_{30}+C_{32}+C_{34}}$$

It is often used to estimate the input of terrestrial-derived materials into sediments (Madureira et al., 1995; Schubert, 1995; Birgel et al., 2004; Bi et al., 2005; Killops and Killops, 2005). In fresh TOM, the CPI typically ranges from about 4 to 10. In contrast, CPI values in marine-derived or mature organic matter reach only 1 (Eglinton and Hamilton, 1963; Hedges and Prahl, 1993).

3.2.2 Fatty Acids

Glycerides are esters of the alcohol glycerol. A glycerol molecule contains three hydroxyl groups and it can react with up to three carboxylic acid molecules, forming mono-, di- and triglycerides, respectively. Fats are triglycerides, formed from straight-chain, aliphatic carboxylic acids, called fatty acids. Thereby the three fatty acids of the triglyceride molecule can by different (Killops and Killops, 2005) (Figure 3.6).

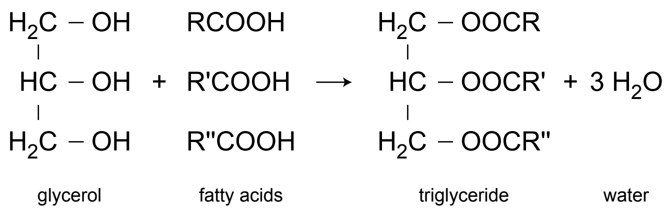


Figure 3.6 Reaction equation of glycerol with three different fatty acids forming a triglyceride molecule and water.

Fatty acids are widely occurring compounds that fulfil a variety of roles, such as cellular membrane components (e.g., phospholipids), energy stores (e.g., triglycerides) and protective coatings (e.g., wax esters). They typically have a chain length between 12 and 36 carbon atoms and they predominantly have even numbers of carbon atoms because they are effectively formed from acetyl (C_2) units. In animals they are predominantly saturated, whereas in plants more mono- and polyunsaturated acids occur. Polyunsaturated acids are more common in algae than in higher plants. The most common fatty acids are C_{16} and C_{18} saturated fatty acids originating from animals and C_{18} mono-, di- and triunsaturated fatty acids originating from plants. Branched-chain fatty acids are a characteristic component of bacteria (Killops and Killops, 2005) (Figure 3.7). Because of their ubiquitous distribution, the C_{16} and C_{18}

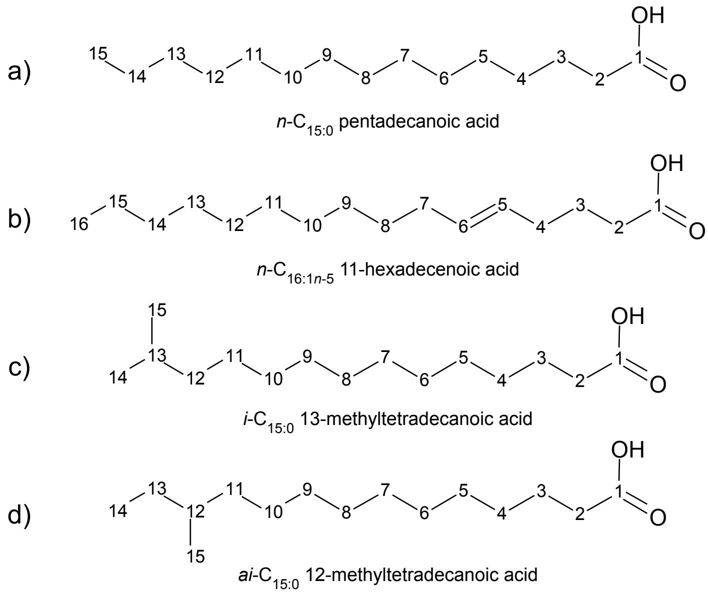


Figure 3.7 Chemical structure and numbering convention of fatty acids considering as example **a)** pentadecanoic acid (saturated), **b)** 11-hexadecenoic acid (monounsaturated) **c)** 13-methylteradecanoic acid (iso) and **d)** 12-methyltetradecanoic acid (anteiso).

saturated fatty acids cannot be used as a source-specific biomarker (Volkman et al., 1998).

Short-chain (C_{14}-C_{22}) saturated and unsaturated fatty acids in marine sediments point to a plankton or bacterial origin of the organic matter (Sargent and Henderson, 1986; Volkman et al., 1989; Kaneda, 1991; Kattner and Hagen, 1995; Pond et al., 1998). In contrast, long-chain (>C_{22}) saturated fatty acids are as well as long-chain *n*-alkanes used as a biomarker for terrestrial origin (Eglinton and Hamilton, 1967; Simoneit, 1978; Naraoka and Ishiwatari, 2000). Below some characteristic fatty acids of different organisms groups, which are used as biomarkers are described in more detail. Abbreviations used for monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA) designate the location of the (first, in case of polyunsaturated fatty acid) double bond with reference to the end of the chain (opposite to the carboxyl group), following the recommendation of the IUPAC-IUB Commission on Biochemical Nomenclature (CBN), 1976.

Primary producers (i.e., microalgae) are a major source of fatty acids in most aquatic sedimentary environments. Diatoms represent the most abundant organism group of primary producers in open-water and sea-ice communities of the high northern latitudes (Gradinger et al., 1999; Sakshaug, 2004). They are dominated by $C_{16:1n-7}$, which accounts for >30% to the fatty acid composition of diatoms (Volkman et al., 1989). Likewise, the fatty acids $C_{14:0}$,

$C_{16:0}$, C_{16} PUFA (especially $C_{16:4n-1}$), $C_{20:4n-3}$ and $C_{20:5n-3}$ show high concentrations in diatoms (Volkman et al., 1989; Fahl and Kattner, 1993; Zhukova and Aizdaicher, 1995; Falk-Petersen et al., 1998; Pond et al., 1998). The major fatty acids of the second important primary producers, the dinoflagellates, are $C_{16:0}$, $C_{18:4n-3}$, $C_{18:5n-3}$, $C_{20:5n-3}$ and $C_{22:6n-3}$ (Falk-Petersen et al., 1998; Pond et al., 1998; Mansour et al., 1999). In addition to the contribution of diatoms and dinoflagellates to the primary production, the contribution of prymnesiophytes, green algae and haptophytes is only of minor importance in the Nordic Seas. Their fatty acid composition shows a spectrum similar to the spectrum of diatoms and dinoflagellates. The major components are $C_{16:0}$, $C_{18:1n-7}$, $C_{18:2n-6}$ and $C_{18:3n-3}$ for prymnesiophytes, $C_{14:0}$, $C_{16:0}$, $C_{18:4n-3}$, $C_{20:5n-3}$ and $C_{22:6n-3}$ for green algae and $C_{18:5n-3}$ and $C_{22:6n-3}$ for haptophytes, respectively (Volkman et al., 1989; Zhukova and Aizdaicher, 1995; Pond et al., 1998).

Secondary producers like zooplankton, benthic organisms and bacteria show also high concentrations of fatty acids and therefore they are an important source for fatty acids in aquatic sediments. Copepods dominate the zooplankton with 70 to 90% of the biomass. In general, they have high amounts of the copepod-specific fatty acids $C_{20:1n-9}$ and $C_{22:1n-11}$ and they also contain significant amounts of C_{18} MUFA. Depending on their diet $C_{16:1n-7}$, $C_{20:5n-3}$ and $C_{22:6n-3}$ are detected, partially in high concentrations (Sargent and Henderson, 1986; Kattner et al., 1989; Kattner and Hagen, 1995; Albers et al., 1996; Scott et al., 2002). Other zooplankton taxa like amphipods, herbivorous krill and pteropods occur in smaller abundances. The fatty acid spectrums of these organisms are characterised by the typical carnivore fatty acid C_{18} MUFA and the diatom- and dinoflagellate-specific fatty acids $C_{16:1n-7}$, $C_{18:4n-3}$, $C_{20:5n-3}$ and $C_{22:6n-3}$ of their feed (Kattner et al., 1998; Falk-Petersen et al., 1999b; Falk-Petersen et al., 2001; Scott et al., 2001; Werner and Auel, 2005). Pteropods contain supplementary significant levels of $C_{15:0}$, $C_{17:0}$ and $C_{17:1n-8}$ (Kattner et al., 1998; Falk-Petersen et al., 2001). Lipid investigations on Arctic benthic organisms of various taxa yield that their fatty acid composition are generally characterised by the predominance of $C_{16:0}$, $C_{20:5n-3}$ and $C_{22:6n-3}$, which are of dietary origin. Remarkable are the extreme low portions of C_{18} MUFA, which is untypical for carnivores (Graeve et al., 1997). Branched-chain fatty acids, yielding *iso* and *anteiso* acids, are found in fungi, molluscs and phytoplankton, but they are generally found in higher abundances in bacteria. Therefore the C_{15} and C_{17} *iso* and *anteiso* fatty acids and also their straight-chain saturated homologues are used as a source-specific biomarker, which point to bacterial origin (Leo and Parker, 1966; Cooper and Blumer, 1968; Perry et al., 1979; Kaneda, 1991). In addition to these fatty acids, bacteria also synthesise various MUFA and PUFA, which are either of minor importance or unspecific and therefore not useful as biomarkers. For example $C_{18:1n\text{-}7}$ has been considered to be a bacteria-specific biomarker (Parkes and Taylor, 1983), but investigations of Russell and Nichols (1999) has shown that this fatty acid is only of minor importance in marine bacteria.

Saturated, straight-chain fatty acids with more than 22 carbon atoms are major components of waxes. These waxes function as protective coatings on higher-plant leaves, flowers and pollen. The long-chain fatty acids show an even-over-odd predominance in carbon numbers (Eglinton and Hamilton, 1967; Naraoka and Ishiwatari, 2000; Kunst and Samuels, 2003). Their occurrence in marine sediments usually is interpreted as of terrestrial origin (Simoneit, 1978; Madureira et al., 1995; Belicka et al., 2002). However, it is suggested that also microalgae and bacteria can produce long-chain fatty acids, albeit only in trace amounts relative to short-chain fatty acids (Volkman et al., 1998 and references therein). Arctic phytoplankton and ice algae have been detected as a possible source for „non-terrestrial“ long-chain fatty acids (Henderson et al., 1998). Stable carbon isotope measurements confirm the suspicion that long-chain fatty acids in marine sediments are a mixture of terrestrial- and marine-derived components (Naraoka and Ishiwatari, 2000; Birgel et al., 2004).

3.2.3 Sterols

Sterols are a subgroup of steroids, which belong to the lipid class of tetracyclic triterpenoids. Steroids are characterised by the sterane structure, a carbon skeleton containing six C_5 isoprene units in a tetracyclic ring structure (Killops and Killops, 2005) (Figure 3.8). They are synthesised both by marine and terrigenous organisms and fulfil a diversity of functions. The carbon-number distribution of regular sterols in young sediments was used to draw a distinction between different groups of organisms and environments (Huang and Meinschein, 1979). However, more recent investigations show that this approach is to simplistic (Volkman, 1986; Volkman et al., 1998; Volkman, 2005). Nevertheless, sterols are used as markers to determine the source of the organic carbon in sediments (Yunker et al., 1995; Birgel and Stein, 2004; Fahl et al., 2003; Yunker et al., 2005) (Figure 3.9).

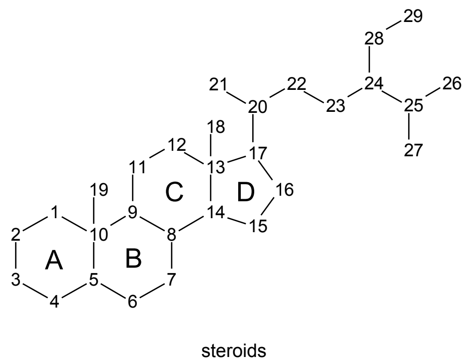


Figure 3.8 Chemical structure and numbering convention of steroids.

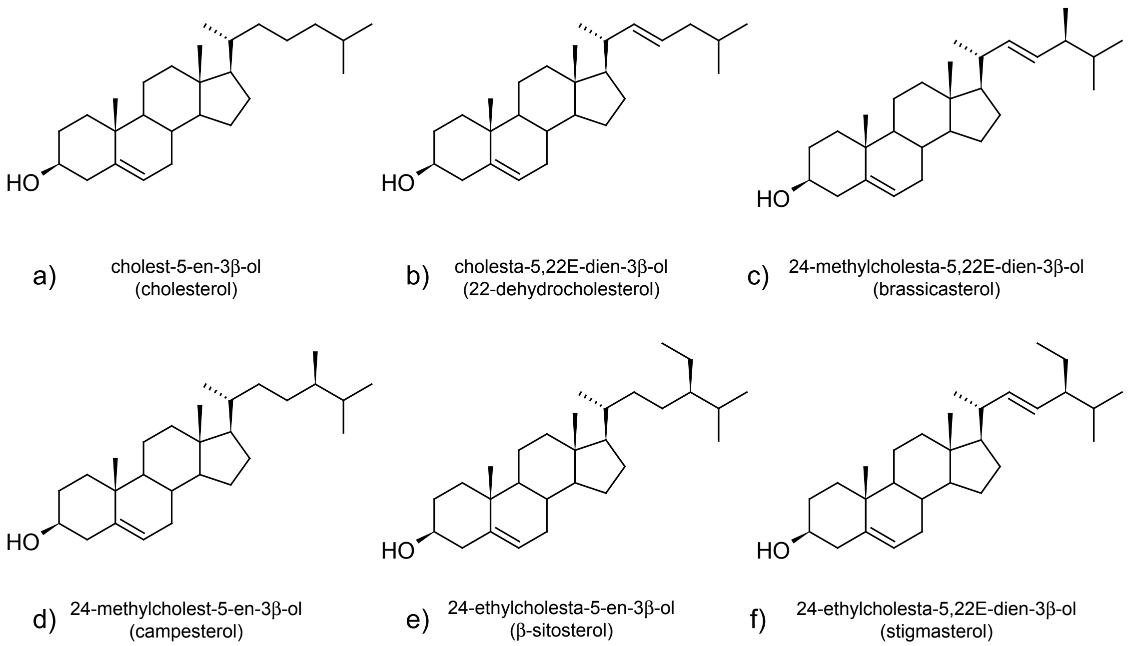


Figure 3.9 Chemical structures of **a)** cholesterol, **b)** 22-dehydrocholesterol, **c)** brassicasterol, **d)** campesterol, **e)** β-sitosterol and **f)** stigmasterol.

In marine environments, high concentrations of cholest-5-en-3β-ol (cholesterol) are generally attributed to marine zooplankton or other marine fauna. Especially zooplankton faecal pellets are a major source of cholesterol in marine sediments. However, phytoplankton can also contain cholesterol in smaller amounts (Volkman, 1986). Cholesta-5,22E-dien-3β-ol (22-dehydrocholesterol) is a major sterol in some common marine diatoms and as cholesterol also 22-dehydrocholesterol derive in significant amounts in faecal pellets (Gagosian et al., 1983; Barrett et al., 1995). Both sterols are additionally reported as major sterols of sea-ice diatoms (Hanke, 1995). Because of the wide distribution of cholesterol and 22-dehydrocholesterol also in the terrigenous environment they are to unspecific to use them as marine biomarkers (Volkman, 1986). In general, 24-methylcholesta-5,22E-dien-3β-ol (brassicasterol) is regarded as a marker for diatom input as it is common and abundant in most diatom species (Volkman, 1986). High concentrations of brassicasterol also occur in some prymnesiophyceae and therefore it is meaningful to use brassicasterol as a phytoplankton marker (Marlowe et al., 1984).

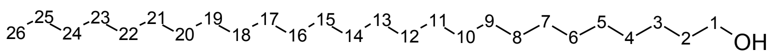
24-Methylcholest-5-en-3β-ol (campesterol), 24-ethylcholesta-5,22E-dien-3β-ol (stigmasterol) and 24-ethylcholesta-5-en-3β-ol (β-sitosterol) are the major sterols found in higher plants (Volkman, 1986; Volkman, 2005). Additionally, a phytoplankton sources especially for β-sitosterol is observed but it has not been clear which phytoplankton species might be potential contributors (Volkman, 1999; Matsumoto, 2001; Méjanelle et al., 2003).

3.2.4 *n*-Alcohols

Saturated, straight-chain alcohols (*n*-alcohols) are like *n*-alkanes biosynthetically derived from fatty acids (Figure 3.10). Their formation by enzymatic reduction processes is responsible for the even-over-odd predominance in carbon numbers (Killops and Killops, 2005) (Figure 3.11).

$$\underset{\text{acid}}{CH_3(CH_2)_nCH_2COOH} \longrightarrow \underset{\text{aldehyde}}{CH_3(CH_2)_nCH_2CHO} \longrightarrow \underset{\text{alcohol}}{CH_3(CH_2)_nCH_2CH_2OH}$$

Figure 3.10 Reaction equation of acid reduction resulting in alcohol formation.



$C_{26:0OH}$ hexacosanol

Figure 3.11 Chemical structure and numbering convention of *n*-alcohols.

Saturated, long-chain *n*-alcohols with more than 22 carbon atoms are major lipid constituents of surface waxes of vascular plants (Eglinton and Hamilton, 1967; Kunst and Samuels, 2003). Similar to pollens, these terrestrial biomarkers can be atmospherically transported as aerosols, sometimes over long distances from source areas (Gagosian and Peltzer, 1986). Saturated, short-chain (<C_{22}) and unsaturated, long-chain *n*-alcohols have been reported as components of aquatic organisms and as the result of metabolism in the aquatic food web. Thereby the *n*-alcohol $C_{22:0}$ is most abundant (Sargent et al., 1977; Bradshaw and Eglinton, 1993; Volkman, 1999 and references therein). Because of the different possible sources for the *n*-alcohol $C_{22:0}$ it is advisable to use only saturated, long-chain *n*-alcohols with more than 24 carbon atoms as a biomarker for TOM.

3.3 Biomarker Groups

Source-specific biomarkers are summarised in three general groups. The assignment of individual compounds to the lipid pools is based on their structure and known occurrence within specific organisms (Chapter 3.2) and the results of compound-specific carbon isotope analysis (Chapter 6.4).

The first group (A) includes compounds derived from **primary production** of marine phytoplankton, and freshwater and sea-ice algae. Biomarkers contributing to this group are:

- short-chain, odd-numbered *n*-alkanes (C_{15}, C_{17}, C_{19})
- algae-specific fatty acids ($C_{14:0}$, $C_{16:1n\text{-}7}$, $C_{16:1n\text{-}5}$, $C_{18:4n\text{-}3}$, $C_{20:4n\text{-}6}$, $C_{20:5n\text{-}3}$, $C_{22:6n\text{-}3}$)
- brassicasterol

Biomarkers of **secondary input**, comprising contributions of bacteria and zooplankton, are summarise in a second group (B). Typical lipids of those organism groups are:

- bacteria-specific fatty acids ($C_{15:0}$, $C_{17:0}$, *i*-C_{15}, *ai*-C_{15}, *i*-C_{17}, *ai*-C_{17})
- zooplankton-specific fatty acids ($C_{18:1n\text{-}9}$, $C_{18:1n\text{-}7}$, $C_{20:1n\text{-}9}$, $C_{20:1n\text{-}7}$, $C_{22:1n\text{-}11}$, $C_{22:1n\text{-}9}$)

The specific biomarkers of **higher plants** are pooled in the third group. Compounds belonging to this group (C) are:

- long-chain, odd-numbered *n*-alkanes (C_{27}, C_{29}, C_{31}, C_{33})
- long-chain, even-numbered fatty acids ($C_{24:0}$, $C_{26:0}$, $C_{28:0}$, $C_{30:0}$, $C_{32:0}$)
- higher plant-specific sterols (campesterol, stigmasterol, β-sitosterol)

Due to analytical problems (coelution) *n*-alcohols are not evaluated and therefore they are not considered.

4 Material and Methods

4.1 Sampling Procedure

The investigated sediment samples are originated from the Nordic Seas (Figure 4.1; Appendix A). The surface sediment samples (0-1 cm) were collected during several expeditions of the RV *Polarstern* (Table 4.1). Sampling was carried out either with a giant box corer (size of 50 x 50 x 60 cm) or with a multicorer (8 tubes, each with diameter of 10 cm). All surface samples for organic-geochemical bulk parameter measurements and biomarker analyses were stored in amber glass bottles at -30°C until further treatment. The additional surface samples for organic-geochemical bulk parameter measurements were stored in Whirl-Pak bags at 4°C. Furthermore, five sediment cores were taken during the cruises ARK-X/2 (Hubberten, 1995) and ARK-XIII/1 (Lemke, 2003) using a gravity corer and a piston corer, respectively. The

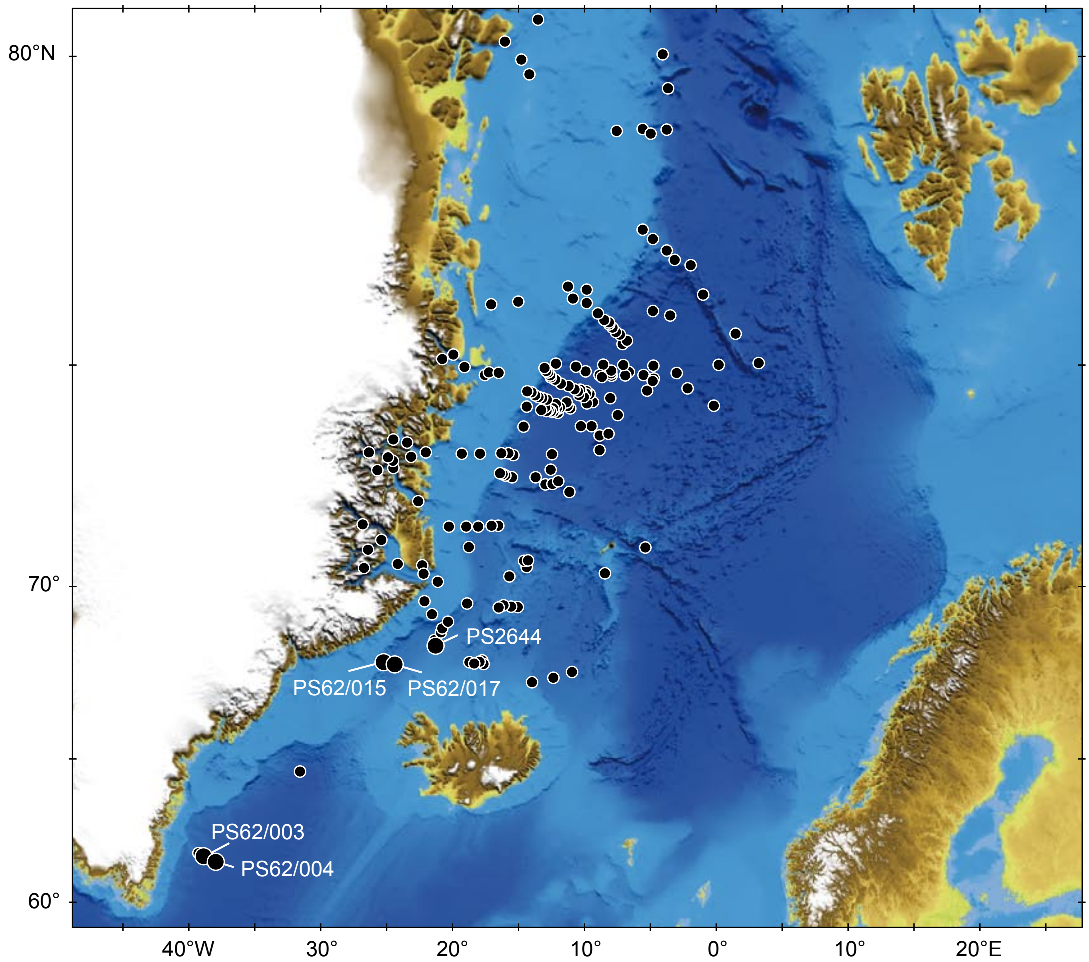


Figure 4.1 Location of investigated surface sediment samples and sediment cores. For a detailed list with coordinates, water depth and zone assignment of all investigated samples see Appendix A.

Table 4.1 List of expeditions.

Expedition	Year	Reference	Area
ARK-V/3b	1988		Central Greenland Sea
ARK-VI/2	1989	Krause et al., 1991	Central Greenland Sea
ARK-VII/1	1990	Thiede and Hempel, 1991	Kolbeinsey Ridge, Central Greenland Sea
ARK-X/2	1994	Hubberten, 1995	East Greenland Fjords and Shelf (70-76°N)
ARK-XI/2	1995	Krause, 1996	Fram Strait, Central Greenland Sea
ARK-XVI/1	2000	Krause and Schauer, 2001	Ardencaple Seachannel, Fram Strait
ARK-XVII/1	2001	Fahrbach, 2002	Ardencaple Seachannel
ARK-XVIII/1	2002	Lemke, 2003	Ardencaple Seachannel, Denmark Strait
ARK-XIX/4	2003	Jokat, 2004	East Greenland Fjords, Shelf and Slope (73-77°N)

cores were logged, opened, described, and sampled on board of RV *Polarstern* during the cruises. Sampling for organic-geochemical bulk parameter measurements was carried out with plastic syringes with a volume of 5 cm^3 and samples were stored in snap-on lid glasses at 4°C until further treatment. "Dirty ice" and Greenland onshore samples were collected during the cruises ARK-XVIII/1 (Lemke, 2003) and ARK-XIX/4 (Jokat, 2004) with the support of helicopters. The sediments of the sea-ice/icebergs and the surface sediments (0-1 cm) of different location along the East Greenland coast were collected by hand using a stainless steel spoon and stored in amber glass bottles at -30°C until further treatment. Figure 4.2 summarises the applied methods and measured parameters for marine surface, sea-ice, and onshore sediments. For the studied sediment cores, only elemental analysis was performed.

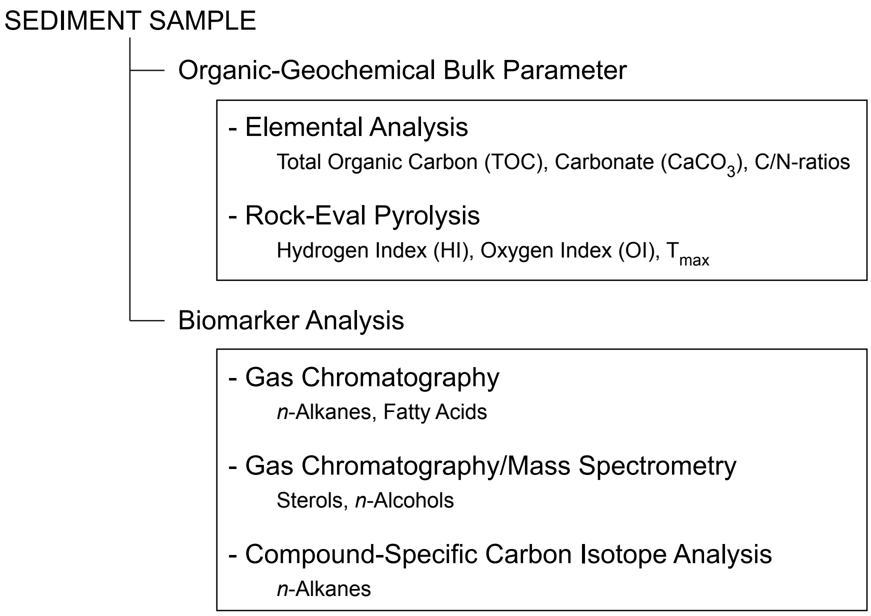


Figure 4.2 Applied methods and measured parameters for marine surface, sea-ice, and onshore sediments.

4.2 Organic-Geochemical Bulk Parameters

All samples for organic-geochemical bulk parameter measurements were freeze-dried and homogenised. The elemental analysis to determine the content of TOC, total carbon (TC) and total nitrogen (N) was performed by means of a LECO CS-125 and a LECO CNS-2000 elemental analyser, respectively. For the analysis of TOC 30 to 50 mg sediment were weighted out into a ceramic crucible. To dissolve the carbonate out of the sediment, some drops ethanol and 0.5 ml hydrochloric acid were added and afterwards the sample was dried on a heating surface for 2 hours at 250°C. Then the crucible was brought in an induction furnace where the sample was combusted using oxygen as carrier gas. The organic carbon was oxidised to carbon dioxide and then detected on an infrared cell. The TOC content was displayed in weight percentage (wt.-%). For the measurement of TC and N no sample preparation was required. A total amount of 150 mg sediment were weighted out into a ceramic crucible and introduced into an induction furnace where the sample was combusted under an oxygen atmosphere. The combustion gases were detected on an infrared cell (carbon dioxide) and a thermal conductivity detector (nitrogen), respectively. TC and N content was also display in wt.-%. Instrumental precision of both elemental analysers was verified regularly by standards and double analyses of samples (Figure 4.3). The precision of the analyser is 0.001 wt.-% (TOC and TC) and 0.01 wt.-% (N), respectively.

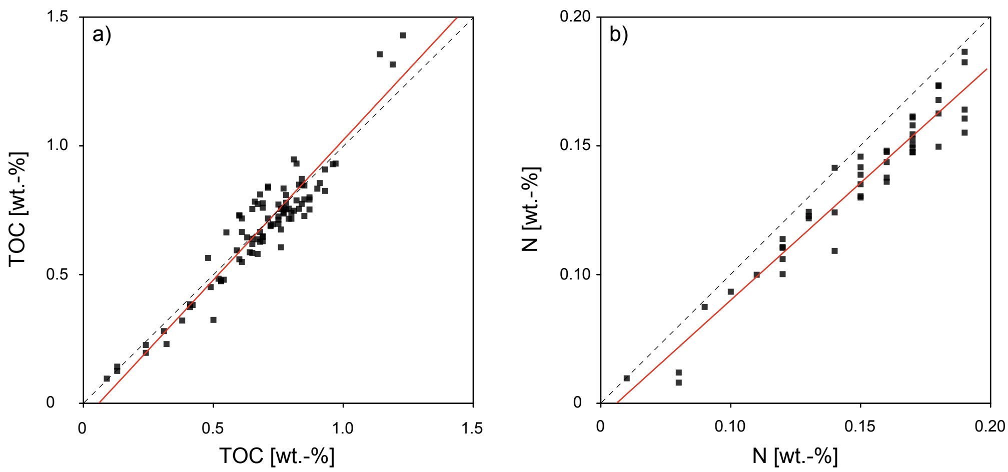


Figure 4.3 Results of double analysis of **a)** TOC by means of LECO CS-125 and **b)** Nitrogen by means of LECO CNS-2000.

The carbonate content ($CaCO_3$) was calculated in wt.-% from the difference of TC and TOC with the use of a conversion factor:

$$CaCO_3 = (TC\text{-}TOC) \times 8.333$$

This formula can be used under the assumption that the whole carbonate is existent as calcite. If larger amounts of other carbonate varieties like dolomite occur, the calculated carbonate content falls short because dolomite has another conversion factor (15.353 instead of 8.333) (Vogt, 1997).

C/N-ratios were calculated as TOC divided by N. Additionally estimations of the inorganic nitrogen proportion (N_{bou}) of the samples was made by using TOC versus N diagrams (see Chapter 3.1.1) and the organic nitrogen (N') was calculated from the difference of N and N_{bou}. The 'inorganic nitrogen'-corrected C/N'-ratios were calculated as TOC divided by N'.

The Rock-Eval Pyrolysis to determine the HI, OI and the peak temperature (T_{max}) was performed by a VINCI Rock-Eval 6 Classic S3 as described by Espitalié et al. (1977) and Behar et al. (2001). For the analysis 100 mg sediment were weighted out into a crucible and introduced into the pyrolysis oven. The sample was progressively heated under an inert nitrogen atmosphere, using the following temperature program: 300°C (3 min), 650°C (rate 25°C/min). The pyrolysis occurred in three steps: first the already existing hydrocarbons were volatilised at a moderate temperature and measured as S1 peak in mg hydrocarbons/g sediment (mg HC/g Sed.) by a flame ionisation detector (FID). The pyrolysis over the period of heating resulted in the generation of volatile hydrocarbons and hydrocarbon-like compounds and oxygen-containing volatiles (i.e. carbon dioxide and water) by cracking of complex non-volatile carbon compounds. The generated volatiles were measured as S2 peak by a flame ionisation detector (hydrocarbons and hydrocarbon-like compounds) also in mg HC/g Sed. and as S3 peak by a thermal conductivity detector (carbon dioxide) in mg carbon dioxide/g sediment (mg CO_2/g Sed.), respectively. The fourth parameter measured with the Rock-Eval 6 apparatus was the peak temperature T_{max} in °C, which corresponds to the maximum of hydrocarbon generation during pyrolysis (Figure 4.4). HI and OI were calculated as HI = (S2 x 100)/TOC in mg hydrocarbons/g TOC (mg HC/g TOC) and OI = (S3 x 100)/TOC in mg carbon dioxide/g TOC (mg CO_2/g TOC), respectively (Espitalié et al., 1977; Tissot and Welte, 1984). The genetic potential (S1+S2) was plotted versus TOC to determine the 'dead carbon' content (DC). With the use of the DC a modified HI was

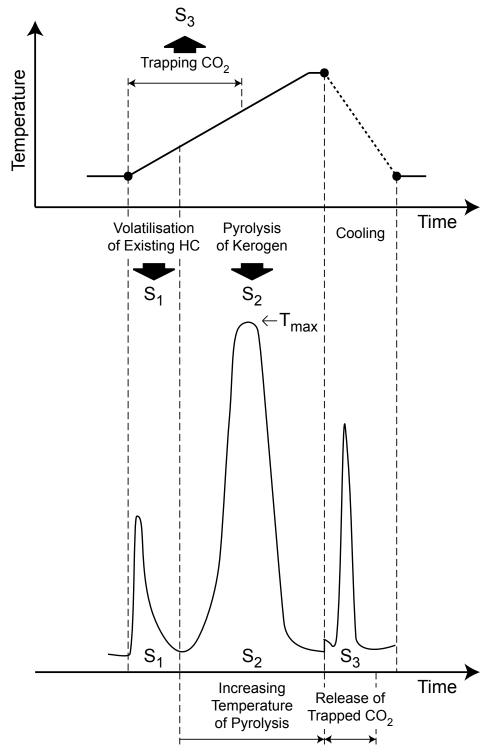


Figure 4.4 Rock-Eval pyrolysis cycle (Tissot and Welte, 1984).

calculated as HI(S1+S2)'=((S1+S2) x 100)/TOC-DC (see Chapter 3.1.2).

4.3 Biomarker Analysis

For biomarker analysis 12 g freeze-dried sediment was extracted and purified by a modified method based on Folch et al. (1957) and Bligh and Dyer (1959) (Figure 4.4). Before any analytical steps the following internal standards were added: 2,6,10,15,19,23-hexamethyltetracosane (squalane), nonadecanoic acid methyl ester (19:0), hentriacontanoic acid methyl ester (31:0) and cholest-5-en-3β-ol-2,2,3,4,4,6-d6 (cholesterol-d6). Sediment samples were extracted in an ultrasonic bath in three steps using 40 ml each of methanol, methanol/dichloromethane (1:1, by volume) and dichloromethane. The whole extract was cleaned twice, once with a solution of 0.88% potassium chloride in purest water (Milli-Q) and once with dichloromethane, and dried over sodium sulfate. Afterwards, the extract was transesterified with 1 ml of 3 n concentrated hydrochloric acid in methanol for 12 hours at 50°C. Subsequently, it was extracted three times with 2 ml of hexane. Silica gel column chromatography was used to separate *n*-alkanes from the fatty acids and the sterols/*n*-alcohols with 5 ml of hexane (*n*-alkanes), 4 ml of dichloromethane (fatty acids) and 5 ml hexane/ethyl acetate (4:1, by volume) (sterols/*n*-alcohols). According to a modified method based on Fahl and Stein (1999) sterols/*n*-alcohols were silylated with 500 µl N, O-bis(trimethylsilyl)trifluotoacetamide with 1% trimethylchlorosilane (BSTFA) for 2 hours at 60°C. Afterwards, the sterol/*n*-alcohol extracts were concentrated up to dry and dissolved in 100 µl hexane. *n*-Alkanes and fatty acids were concentrated up to a volume of 100 µl using special glass containers after Dünges (1979). With the use of the special glass containers, a gentle concentration of the extracts under a partial backflow occurs. This method enables the quantitative analysis even of short-chain *n*-alkanes and fatty acids (<C_{19}) (Dünges et al., 1990) (Figure 4.5).

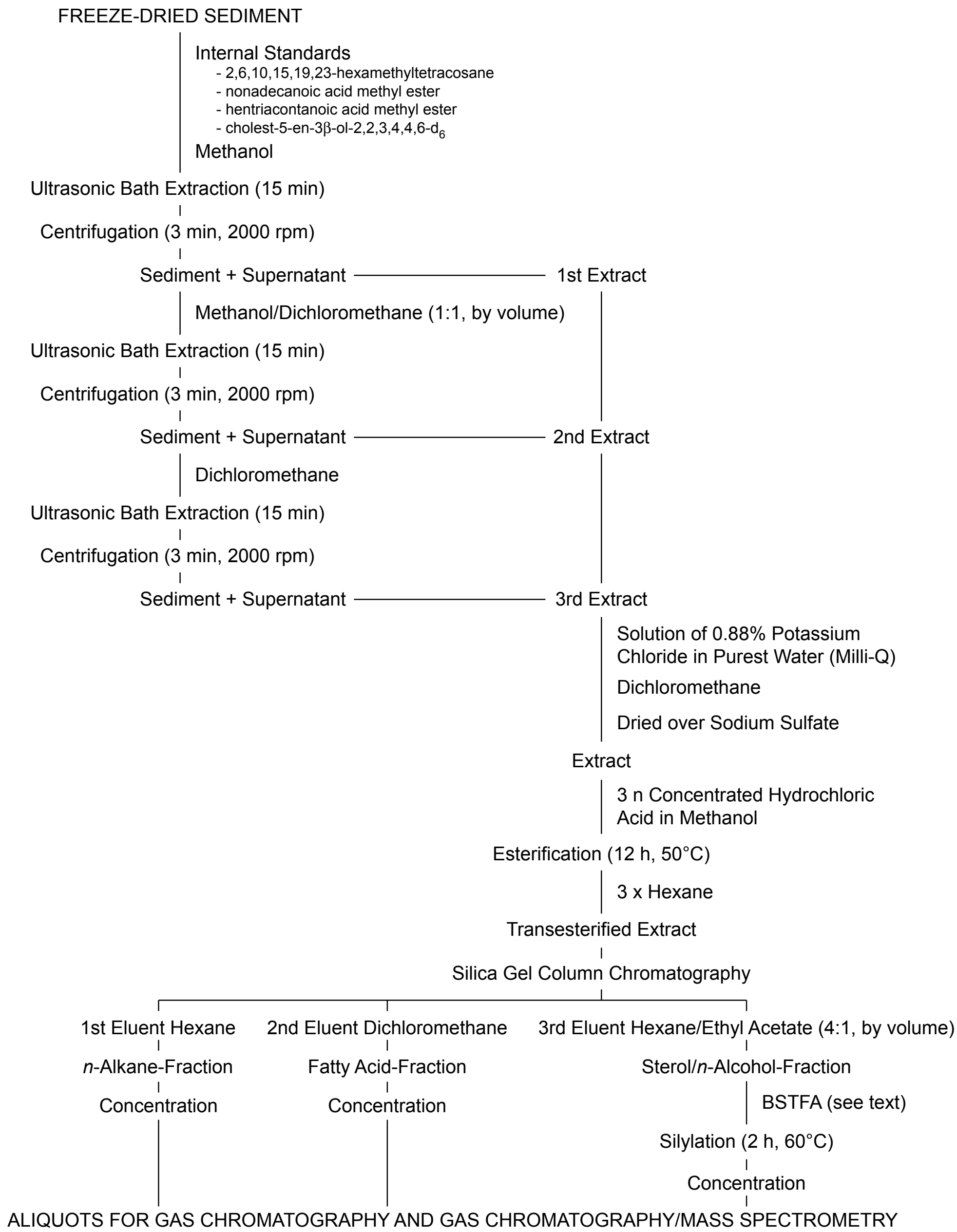


Figure 4.5 Flow chart of biomarker extraction.

n-Alkanes and fatty acids were analysed with a Hewlett-Packard gas chromatograph (HP 6890) on a 30 m DB5-MS capillary column (J & W Scientific, diameter 0.25 mm, film thickness 0.25 µm) using the following temperature program: 60°C (2 min), 150°C (rate 15°C/min), 320°C (rate 3°C/min), 320°C (10 min isothermal). The injection volume was 1 µl (Gerstel Cold Injection System: 60°C (10 s), 300°C (60 s), rate 12°C/s). Helium was used as carrier gas. Identification of compounds was achieved from GC retention times and MS fragmentation patterns. Sterols/*n*-alcohols were analysed by GC/MS technique. The GC/MS consists of a Hewlett-Packard gas chromatograph (HP 5890) with a 30 m DB5-MS capillary column (J & W Scientific, diameter 0.25 mm, film thickness 0.25 µm) and a Hewlett-Packard mass spectrometer (MSD, HP 5972, 70 eV electron-impact-ionisation, Scan 50-650 m/z, 1 scan/s, ion source temperature 175°C) using the following temperature program: 60°C (2 min), 150°C (rate 15°C/min), 320°C (rate 3°C/min), 320°C (10 min isothermal). The injection volume was 1 µl (splitless). Helium was used as carrier gas. Identification of the compounds based on MS fragmentation patterns. Quantification of all compounds was achieved by the peak area ratio of the evaluated compound and an internal standard. Discrimination between natural cholesterol and cholesterol-d6 based on a ratio, calculated from the abundance of mass fragment 368 (natural cholesterol) and mass fragment 374 (cholesterol-d6).

Compound-specific carbon isotope analysis (irm-GC/MS) of selected samples were carried out with a HP 6890 GC coupled via a Finnigan GCC-II-interface to a Finnigan DeltaplusXL gas mass spectrometer. Samples were injected in pulsed-splitless mode and compound separation was achieved on a J & W DB1-MS capillary column (length 60 m, diameter 0.32 mm, film thickness 0.25 µm). Helium was used as carrier gas. The GC-temperature was programmed from 30°C (5 min) to 150°C (15°C/min) and then to 320°C (20 min) at a rate of 3°C/min. Carbon isotope ratios are notated as δ-values ($\delta^{13}C$ in ‰) relative to the PDB-standard and have been corrected for the addition of carbon during derivatisation. Several CO_2-pulses of known $\delta^{13}C$ value at the beginning of each run were used for calibration. Reported $\delta^{13}C$ values were obtained by two to three replicate analyses of each sample to calculate the average carbon isotopic composition. Instrumental precision was checked regularly with standard mixtures of *n*-alkanes (C_{16}-C_{30}), fatty acid methyl esters (C_{19}, C_{31}) and cholesterol-d6, all of known carbon isotopic composition and resulted in standard deviations <0.4. The measurements were carried out by J. Hefter.

4.4 Accumulation Rates

Accumulation rates (MAR in g Sed./cm² ka) were calculated under consideration of linear sedimentation rates (LSR in cm/ka), wet bulk density (WBD in g Sed./cm^3) and porosity (PO in %) as MAR=LSR x (WBD - 1.026 x (PO/100)) (van Andel et al., 1975). This method allows minimising the effect of compaction by sediment upload and therefore to calculate the effectively deposited material per time and area. The accumulation rates of organic carbon (AR-OC in g TOC/cm^2 ka) were calculated as AR-OC = (TOC/100) x MAR. Data of physical properties for the calculation of accumulation rates has been taken from the PANGAEA-database (PANGAEA, 2006).

4.5 Box-and-Whisker Plots

The box-and-whisker plot (box plot) is a graphical representation of key values from summary statistics. Typically, the values represented are the minimum, 25th percentile, median, 75th percentile, and the maximum. A number of other slightly different conventions are common. In this study box plots representing the 10th percentile, 25th percentile, median, 75th percentile, and the 90th percentile were used (Figure 4.6).

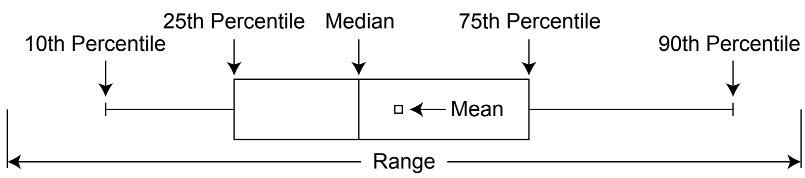


Figure 4.6 Box-and-whisker plot

5 Stratigraphy of Sediment Cores

5.1 Age Models

The startigraphic control of the investigated sediment cores is essential for the purpose of paleoenvironmental reconstructions. The age models for the studied cores are from Voelker (1999) and Millo et al. (2005; 2006).

The chronology of cores PS62/003 and PS62/004 is based on correlation of epibenthic $\delta^{18}O$ records with the ^{14}C-dated epibenthic $\delta^{18}O$ record of neighbour core SU90-24 (Elliot et al., 1998; 2002). The age models for PS62/015 and PS62/017 are based on both $\delta^{18}O$ and paleomagnetic stratigraphy. The primary age control for the past 75 ka is based on a correlation of relative magnetic paleointensity signals in cores PS62/015 and PS62/017 with the reference record NAPIS 75 (Laj et al., 2000). On basis of this magneto-startigraphic framework planktic $\delta^{18}O$ records of cores PS62/015 and PS62/017 were fine-tuned to the high-resolution planktic $\delta^{18}O$ record of neighbour core PS2644. Core PS2644 has a robust chronology based on numerous ^{14}C datings and tuning to the incremental time scale of the Greenland Ice Sheet Project 2 (GISP2) (Voelker, 1999).

Figure 5.1 illustrates the age-depth relation of the investigated sediment cores. Both cores taken south of the Denmark Strait (PS62/003 and PS62/004) are characterised by a various long hiatus on top of the cores. While the age dated sediment record of core PS62/003 begins at 14.7 ka BP and comprehends sediments of the deglaciation and the last glacial, the hiatus on to of core PS62/004 spans the time back to end of the last glacial (29.7 ka BP). The age models of these both cores reach back to marine isotope stage 3 (MIS 3) (47.8 ka BP (PS62/003) and 46.8 ka BP (PS62/004)). For the deeper parts of the sediment records (600-1240 cm (PS62/003) and 220-1290 cm (PS62/004)) no age models are developed. Generally, the northern sediment cores (PS62/015, PS62/017 and PS2644) span a longer time. The age dated sediment record of the reference core PS2644 (20-896 cm) spans the time between 11.4 and 83.7 ka. The two other northern cores include nearly the same time span and the reach from the present back to 86.5 and 78.1 ka, respectively.

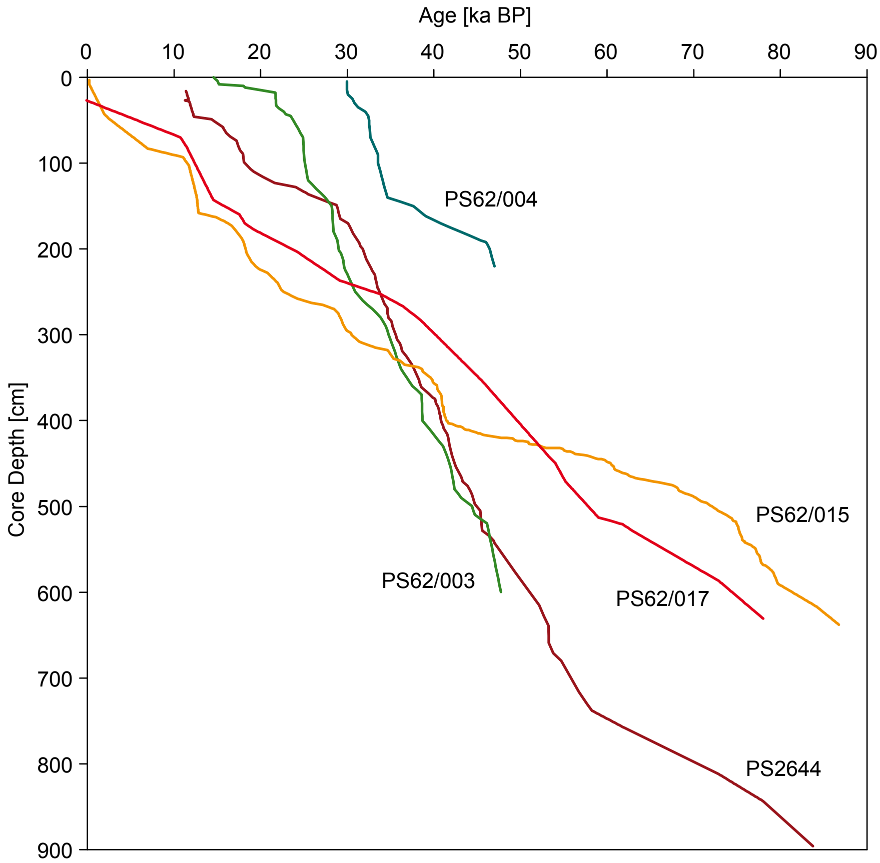


Figure 5.1 Age-detpth relation of the sediment cores PS62/003, PS62/004, PS62/015, PS62/017, and PS2644 (modified after Voelker et al. 1999; Millo et al., 2005; 2006).

5.2 Sedimentation and Accumulation Rates

Due to the missing age models for deeper sections of sediment cores PS62/003 and PS62/004, linear sedimentation and accumulation rates were presented for the sediment cores PS62/015, PS62/017, and PS2644 only. High linear sedimentation rates are calculated for the end of MIS2 in all sediment cores and additionally for MIS 3 in sediment core PS2644 (Figure 5.2). Lowest values are calculated for MIS 4. The linear sedimentation rates are reflected in the mass accumulation rates (Figure 5.3). Mass accumulation rates of sediment cores PS62/015 and PS62/017 are obvious lower than thoses of sediment core PS2644. In general, mass accumulation rates are lower during MIS2 and MIS4 and they increase during MIS 1, MIS 3, and MIS 5. During MIS 2 the mass accumulation rate of sediment core PS2644 increases for a short time span to clearly higher values. The smooth record of mass accumulation rates of sediment core PS2644 is due to the calculation of mean mass accumulation rates for longer time spans from a higher resolution record.

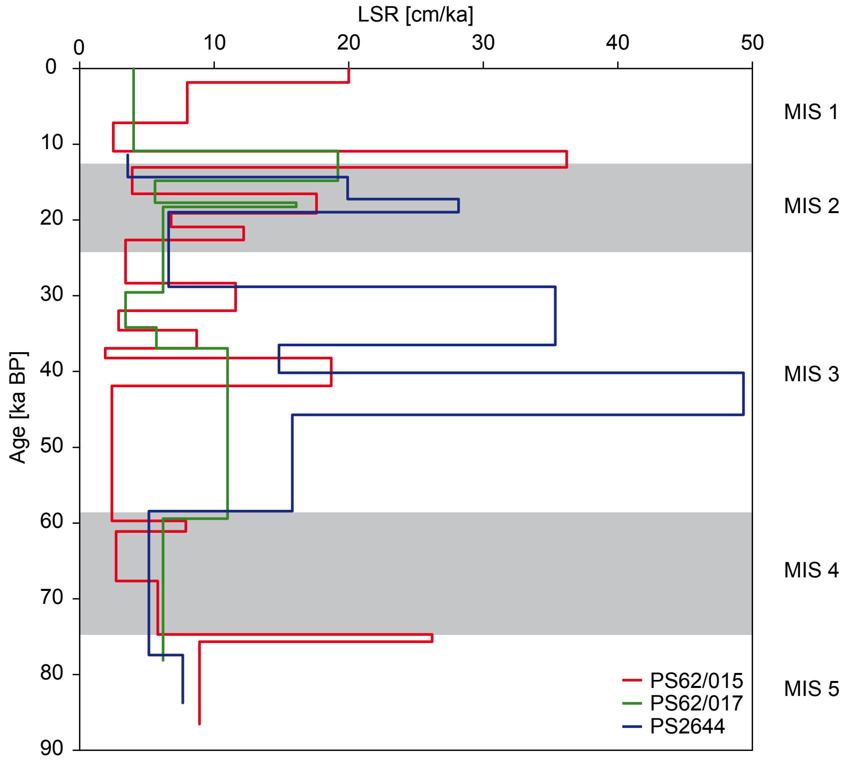


Figure 5.2 Linear sedimentation rates (cm/ka) of sediment cores PS62/015, PS62/017, and PS2644 versus calendar age (ka BP). Grey bars mark marine isotope stages MIS 2 and MIS 4, respectively.

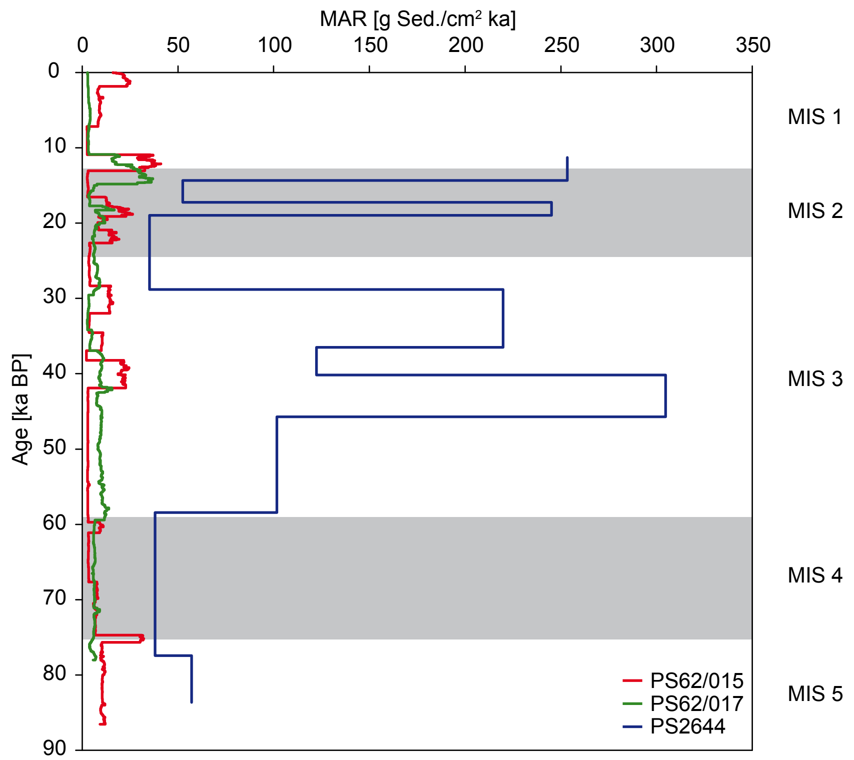


Figure 5.3 Mass accumulation rates (g Sed./cm^2 ka) of sediment cores PS62/015, PS62/017, and PS2644 versus calendar age (ka BP). Grey bars mark marine isotope stages MIS 2 and MIS 4, respectively.

6 Results

6.1 Grouping of Samples and Data Presentation

Based on the geographical, hydrological and environmental settings, and the results of the organic-geochemical bulk parameter and biomarker analyses, the samples are arranged in six different zones characterising different regions of the investigation area, whereas two zones are of non-marine and four zones are of marine origin. The two zones of non-marine origin are the *Onshore Zone* (OZ), in which samples originating from East Greenland, and the *Sea-Ice Zone* (SIZ), in which sediment samples from sea ice and icebergs, are summarised. The four

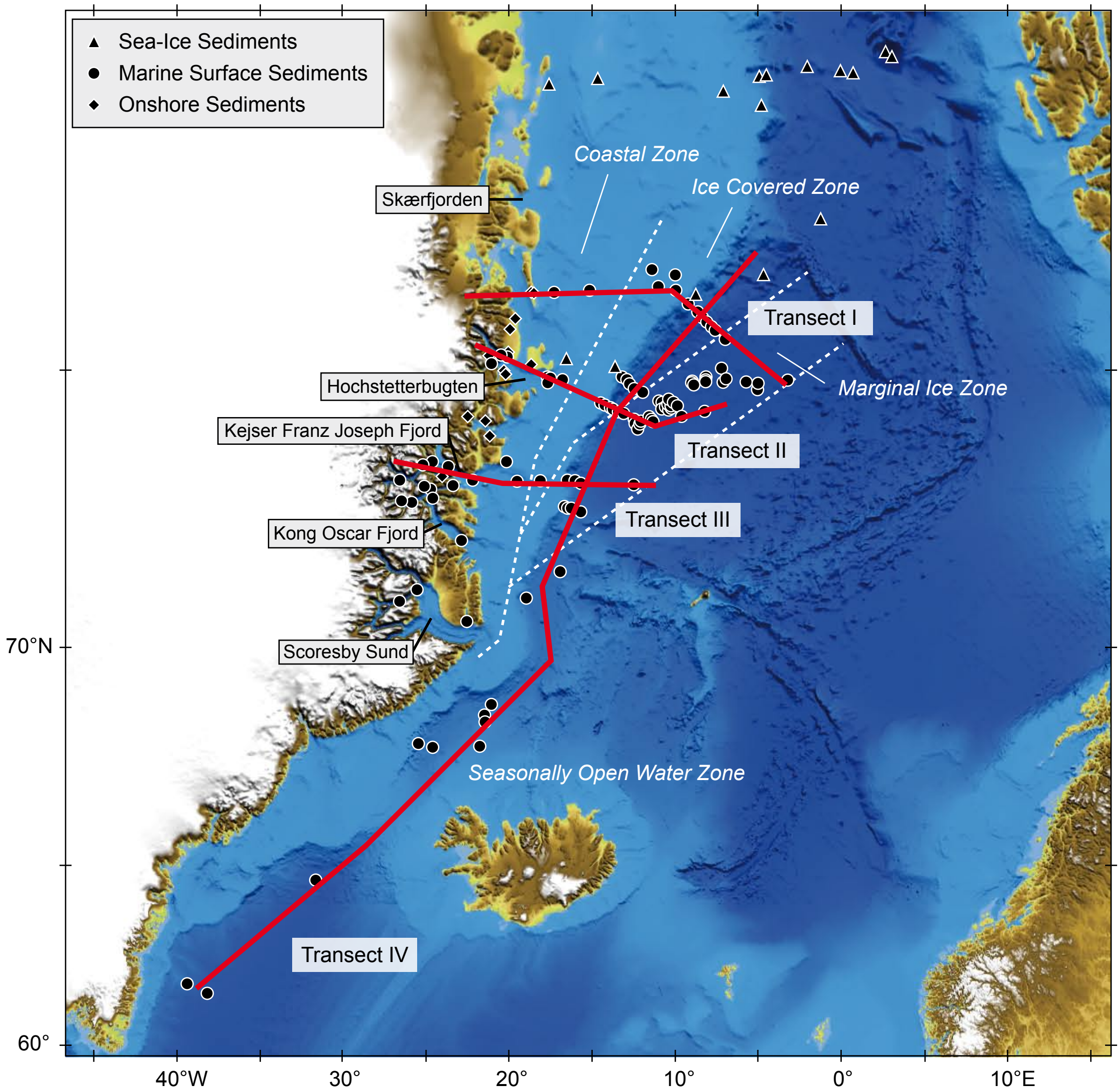


Figure 6.1 Location of investigated marine surface, sea ice, and onshore sediment samples and location of transects I to IV. For a detailed list with coordinates, water depth and zone assignment of all samples see Appendix A.

zones of marine origin are the *Coastal Zone* (CZ), *Ice Covered Zone* (ICZ), *Marginal Ice Zone* (MIZ) and *Seasonally Open Water Zone* (SOZ). Additional, selected samples were arranged onto four different transects (Transect I to IV; Figure 6.1). The transects I to III are nearly west-east transects beginning on the East Greenland coast, running across the fjords, shelf and continental margin and ending in the deep sea. They are located between 73° and 76°N. Transect IV is a northeast to southwest transect along the East Greenland continental margin between 77° and 62°N. For a detailed list with the results of all stations see Appendix A.

The compound-specific distribution maps used in Chapter 6 are generated with a Quick Gridding Algorithm, those used in Chapter 7 are generated with a VG Gridding Algorithm. Both Gridding Algorithms are supplied by the ODV-software package (Schlitzer, 2004). The distribution maps of TOC and carbonate in the Nordic Seas are based on own measurements and additional data from previous studies (Mackensen, 1985; Birgisdottir, 1991; Paetsch, 1991; Pagels, 1991; Baumann et al., 1993; Hebbeln and Berner, 1993; Stein et al., 1994; Marienfeld, 1996; Taylor et al., 2002 and references therein; Winkelmann, 2003; Birgel et al., 2004; Schäfer, 2005; Winkelmann and Knies, 2005; Stein unpublished). The locations of the used surface sediment samples are shown in Figure 6.2. The biomarker-distribution maps are based on own measurements and biomarker concentrations are displayed in µg Substance/ g Sediment (µg/g Sed.) and µg Substance/ g Organic Carbon (µg/g TOC). Whereas the absolute concentrations give information about the absolute amounts of specific components in the sediment, the relative concentrations give information about the composition of the extractable organic matter.

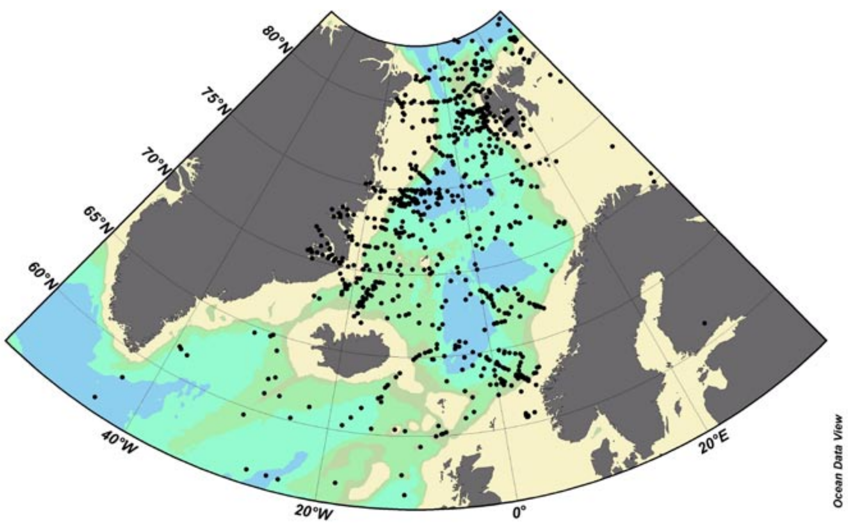


Figure 6.2 Location of stations used for the generation of the TOC and carbonate distribution maps .

6.2 Organic-Geochemical Bulk Parameters in Modern Sediments

6.2.1 Nordic Seas

The modern distribution of TOC contents in modern sediments of the Nordic Seas shows an east-west gradient (Figure 6.3). The Greenland-Scotland Ridge and the East Greenland fjords display the lowest levels (<0.3 wt.-%), while the northern East Greenland shelf, Boreas Basin, Iceland Plateau, western Norway Basin, and Vøring Plateau have slightly higher TOC contents (0.3-0.6 wt.-%). The other basins show TOC contents between 0.6 and 0.9 wt.-%. Locally high contents of TOC (1.0-1.5 wt.-%) are reached in front of the Skærfjorden, Hochstetterbugten, and Kong Oscar Fjord. The contents of TOC increases towards the eastern part of the Nordic Seas. Highest TOC values (1.0-2.6 wt.-%) are observed around Svalbard, in the Barents Sea, the eastern Fram Strait, and on the Yermak Plateau.

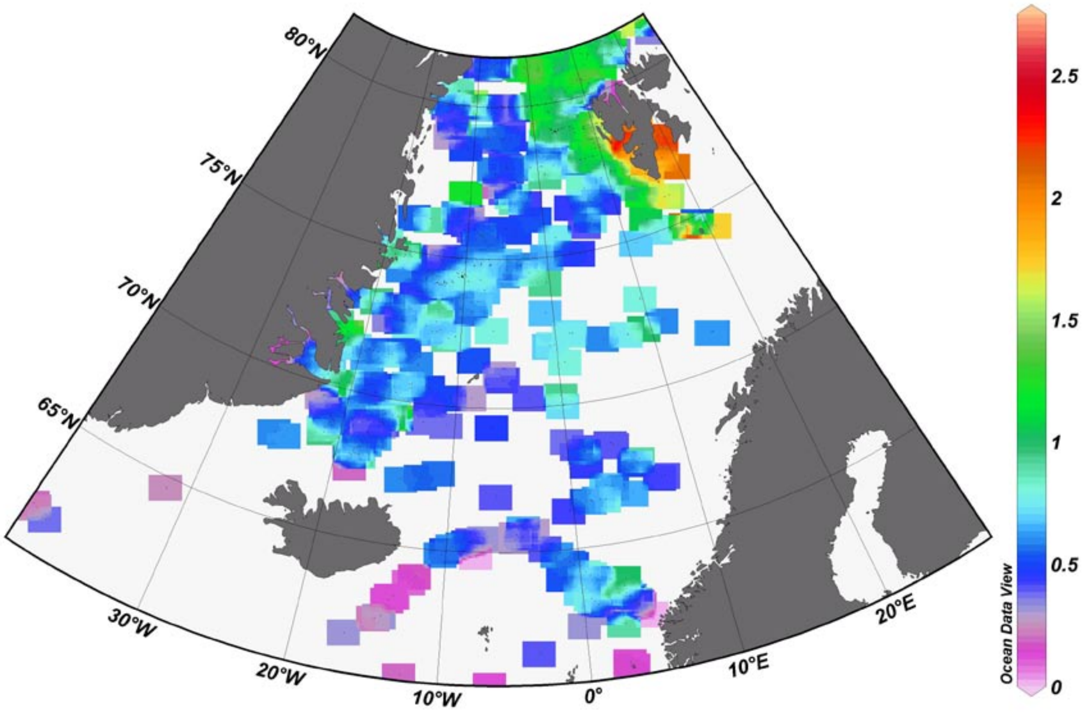


Figure 6.3 Contents of TOC (in wt.-%) in surface sediments of the Nordic Seas (Mackensen, 1985; Birgisdottir, 1991; Paetsch, 1991; Pagels, 1991; Baumann et al., 1993; Hebbeln and Berner, 1993; Stein et al., 1994; Marienfeld, 1996; Taylor et al., 2002 and references therein; Birgel et al., 2004; Schäfer, 2005; Winkelmann and Knies, 2005; Stein unpublished; this study).

The pattern of carbonate content in modern sediments of the Nordic Seas is similar to that of TOC and it also shows a distinct east-west gradient but some prominent differences are apparent (Figure 6.4). Low carbonate contents occur in the western and northern Nordic Seas. The Fram Strait, the East Greenland fjords and shelf, the Scoresby and Blosseville Basin, and the Greenland-Scotland Ridge show lowest carbonate contents (0-10 wt.-%). In the Greenland and Boreas Basin contents between 20 and 40 wt.-% are reached. The highest carbonate values (20-60 wt.-%) are displayed in the eastern Nordic Seas, namely the Lofoten and Norway Basin. In general the carbonate contents on the shelves are lower than those in the adjacent deep-sea basins.

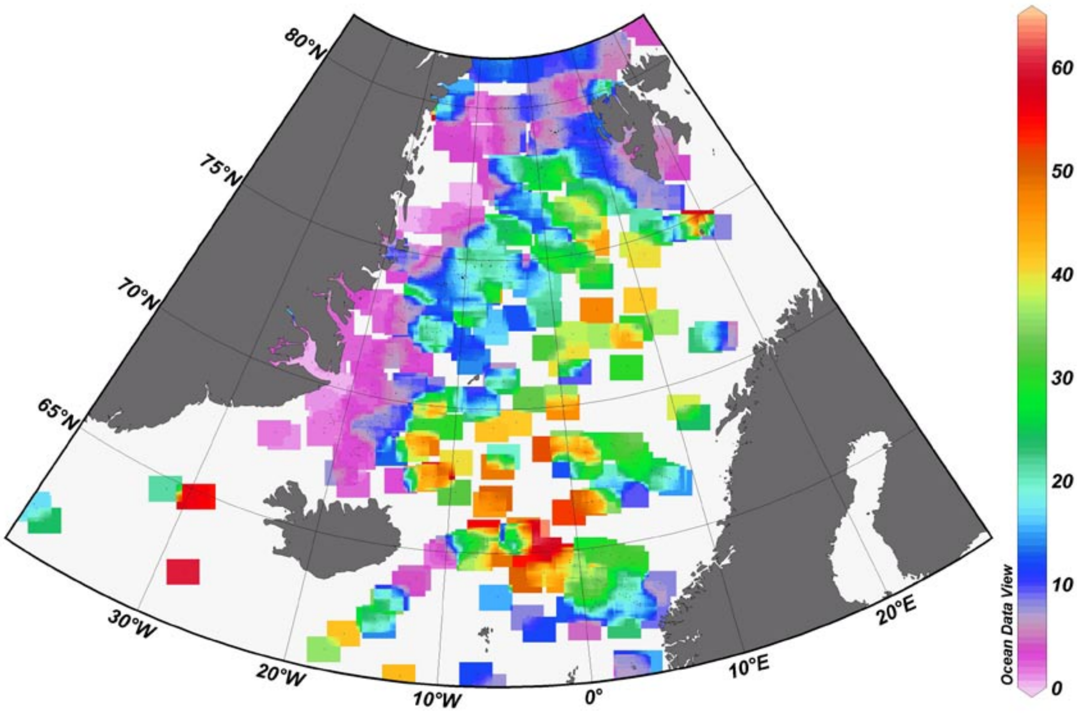


Figure 6.4 Contents of carbonate (in wt.-%) in surface sediments of the Nordic Seas (Mackensen, 1985; Birgisdottir, 1991; Paetsch, 1991; Pagels, 1991; Baumann et al., 1993; Hebbeln and Berner, 1993; Stein et al., 1994; Marienfeld, 1996; Taylor et al., 2002 and references therein; Winkelmann, 2003; Birgel et al., 2004; Schäfer, 2005; Stein unpublished; this study).

6.2.2 East Greenland Continental Margin

The TOC contents in the investigated marine sediment samples originating from the East Greenland continental margin vary between 0.09 and 1.02 wt.-%. Samples of the sub-group *Coastal* show highest variability (SD=0.32 wt.-%) in TOC contents (0.1-1.0 wt.-%). The lowest TOC contents (0.1-0.3 wt.-%) are measured in the inner part of the fjord systems whereas the highest TOC values (0.9-1.2 wt.-%) occur on the inner shelf in front of the

Hochstetterbugten and Kong Oscar Fjord. Samples of the *Ice Covered Zone* have the lowest mean TOC content (0.47 wt.-%) and show low variability (SD=0.09 wt.-%). The TOC contents increase in samples of the *Marginal Ice Zone*, ranging around the mean of 0.73 wt.-%. Also samples of the *Seasonally Open Water Zone* have a relative high mean TOC content (0.59 wt.-%) but values are more variable (SD=0.21 wt.-%). Samples originating from the Kolbeinsey Ridge and the deep-sea south of Jan Mayen are characterised by lower TOC contents between 0.2 and 0.5 wt.-% whereas the TOC contents of other samples of the zone range between 0.5 and 0.9 wt.-% (Figure 6.5; Figure 6.11; Table 6.1).

Onshore Zone and *Sea-Ice Zone* samples have TOC contents between 0.03 and 0.95 wt.-% and 0.79 and 2.77 wt.-%, respectively. Neither in *Onshore Zone* nor in *Sea-Ice Zone* samples a distinct distribution is recognisable (Figure 6.6; Figure 6.11; Table 6.1).

Table 6.1 Mean, minimum (min.), maximum (max.) and standard deviation (SD) of TOC and carbonate (both in wt.-%), C/N-ratios, hydrogen indicies (HI) and modified hydrogen indicies (HI(S1+S2)') (both in mg HC/g TOC), oxygen indicies (OI) (in mg CO_2/g TOC) and T_{max} (in °C) in sediment samples of the different subgroups. For zone assignment of samples see Chapter 6.1. n = number of samples included.

	Coastal Zone (n=19)				*Ice Covered Zone* (n=20)				*Marginal Ice Zone* (n=54)			
	mean	min.	max.	SD	mean	min.	max.	SD	mean	min.	max.	SD
TOC	0.51	0.09	1.02	0.32	0.47	0.27	0.62	0.09	0.73	0.28	0.92	0.10
$CaCO_3$	3	0	26	6	10	1	29	9	15	2	24	5
C/N	9	5	14	2	7	7	8	1	7	6	8	1
HI	87	36	168	32	83	65	101	10	79	68	104	6
HI(S1+S2)'	113	44	273	52	103	83	129	13	98	85	127	7
OI	348	201	622	127	412	228	560	88	478	369	606	50
T_{max}	390	337	426	34	388	338	475	45	418	400	426	4

	Seasonally Open Water Zone (n=15)				*Onshore Zone* (n=13)				*Sea-Ice Zone* (n=28)			
	mean	min.	max.	SD	mean	min.	max.	SD	mean	min.	max.	SD
TOC	0.59	0.20	0.93	0.21	0.33	0.03	0.95	0.11	1.38	0.79	2.77	0.45
$CaCO_3$	10	1	47	13	2	0	16	4	2	1	6	1
C/N	7	7	8	1	13	8	18	3	9	1	13	1
HI	80	62	120	15	120	39	259	61	155	66	312	65
HI(S1+S2)'	99	78	143	17	[1]229	[1]115	[1]343	[1]88	[2]350	[2]175	[2]597	[2]99
OI	484	320	1026	209	261	127	404	82	188	136	395	47
T_{max}	366	340	422	28	389	291	425	41	398	290	430	46

[1] (n=9); [2] (n=27)

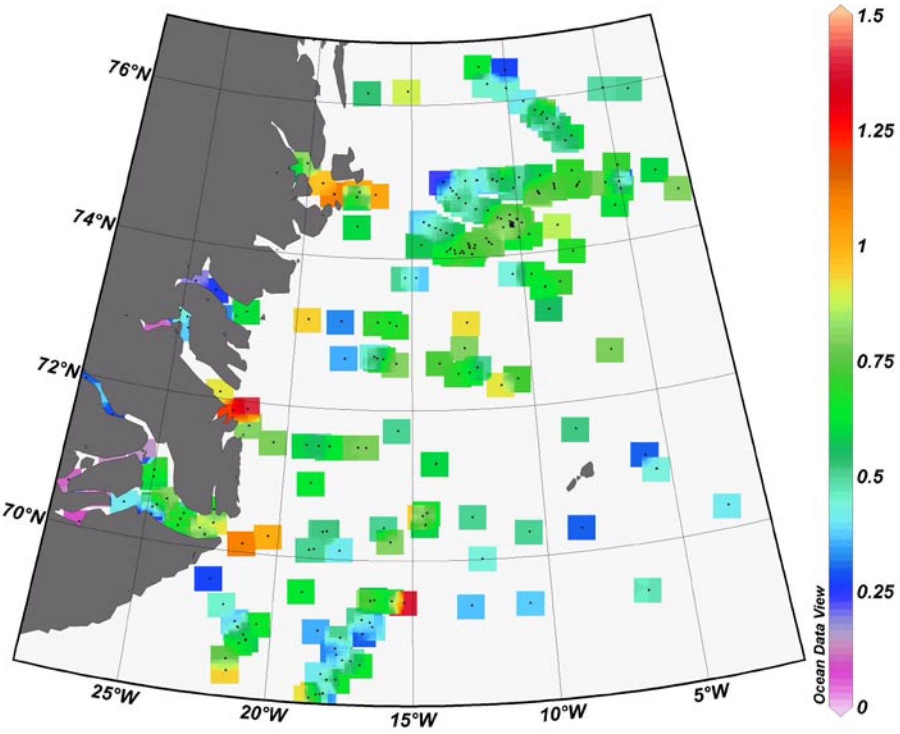


Figure 6.5 Contents of TOC (in wt.-%) in marine surface sediments of the East Greenland continental margin.

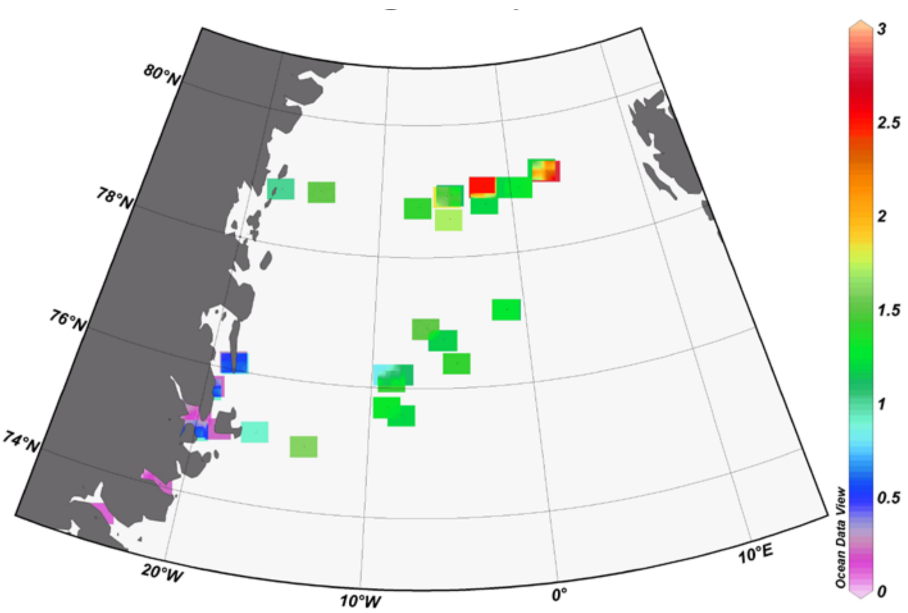


Figure 6.6 Contents of TOC (in wt.-%) in *Onshore Zone* and *Sea-Ice Zone* sediments of the East Greenland continental margin.

The marine sediments show carbonate contents between 0 and 47 wt.-%. The distribution shows a distinct east-west gradient. Low carbonate values (0-10 wt.-%) occur in fjord, shelf, and southern slope sediments. Northern slope and deep-sea sediments north of Jan Mayen are characterised by carbonate concentrations between 10 and 20 wt.-%. Samples originating from the Greenland and Norway Basin have maximum carbonate concentrations between 20 and 40 wt.-% and 20-60 wt.-%, respectively. Carbonate contents in the *Ice Covered Zone* and *Seasonally Open Water Zone* are high variable (SD=9 and 13 wt.-%) whereas in *Coastal Zone* and *Marignal Ice Zone* samples the values are more uniform (SD=6 and 5 wt.-%). *Marignal Ice Zone* samples have the highest mean TOC value (15 wt.-%) (Figure 6.7; Figure 6.11; Table 6.1).

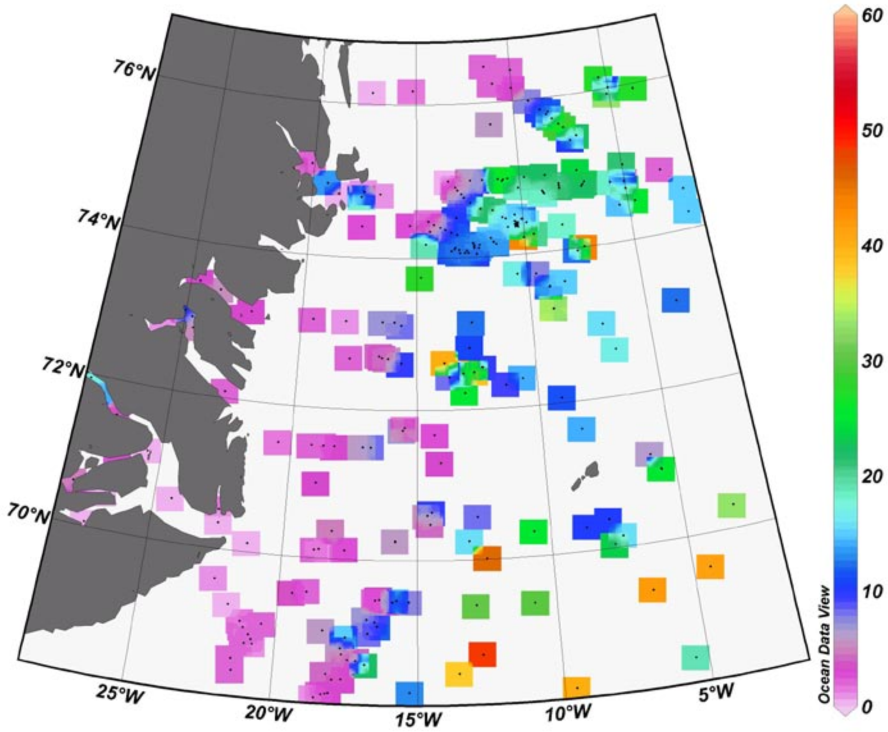


Figure 6.7 Contents of carbonate (in wt.-%) in marine surface sediments of the East Greenland continental margin.

Onshore Zone and *Sea-Ice Zone* samples are characterised by low carbonate values (0-16 wt.-% and 1-6 wt.-%) and they show no noticeable distribution pattern (Figure 6.8; Figure 6.11; Table 6.1)

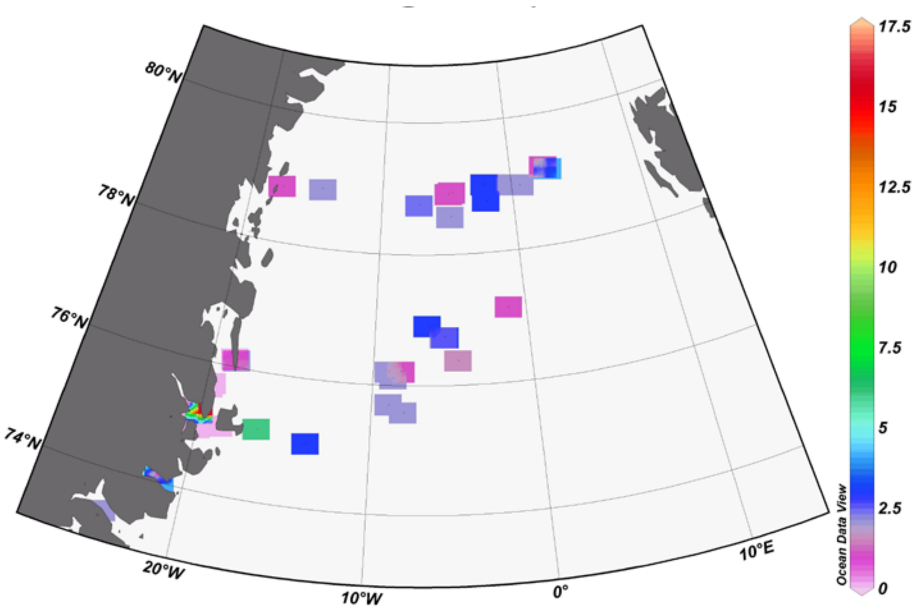


Figure 6.8 Contents of carbonate (in wt.-%) in *Onshore Zone* and *Sea-Ice Zone* sediments of the East Greenland continental margin.

It has to be considered that the C/N-ratios are calculated as "TOC/total nitrogen" and that high amounts of inorganic nitrogen (N_{bou}) cause undervalued C/N-ratios (see Chapter 3.1.1). Therefore total nitrogen (N) was plotted versus TOC to determine N_{bou}. The results of these plots for samples of the different zones show that in all samples no significant amounts of N_{bou} occur (Appendix B). C/N-ratios in *Coastal Zone* sediments range between 5 and 14. All other marine zones are characterised by a C/N-ratio of 7 (SD=1) (Figure 6.9; Figure 6.11; Table 6.1).

Onshore Zone samples have C/N-ratios above 10 reaching maximum values of 18 whereas the *Sea-Ice Zone* sediments have lower C/N-ratios between 7 and 13 (Table 6.1). Regularity in the distribution is not recognisable (Figure 6.10; Figure 6.11; Table 6.1).

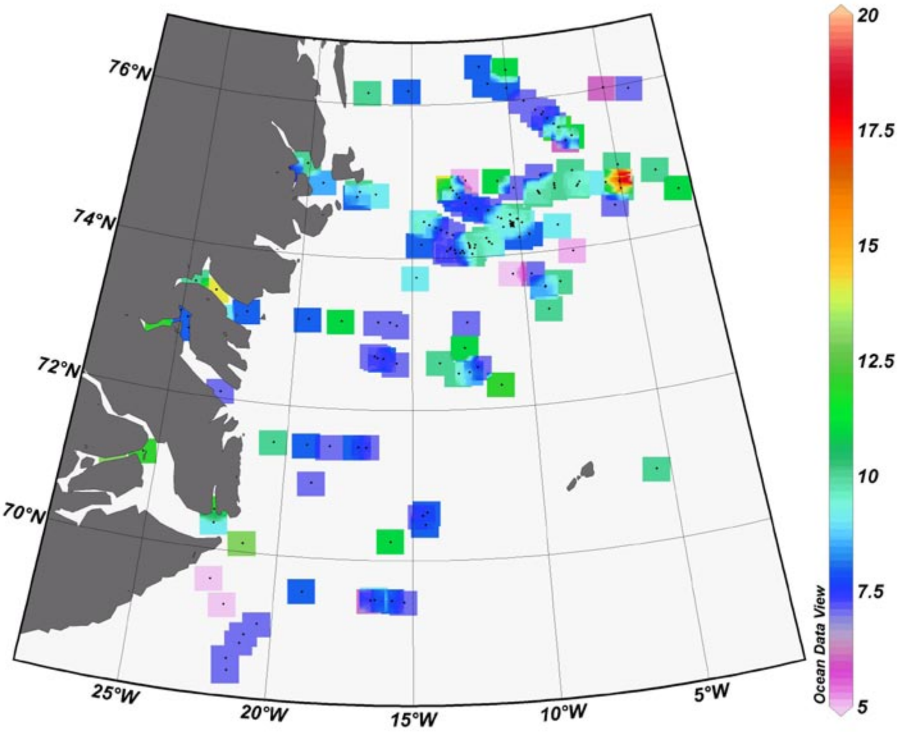


Figure 6.9 C/N-ratios in marine surface sediments of the East Greenland continental margin.

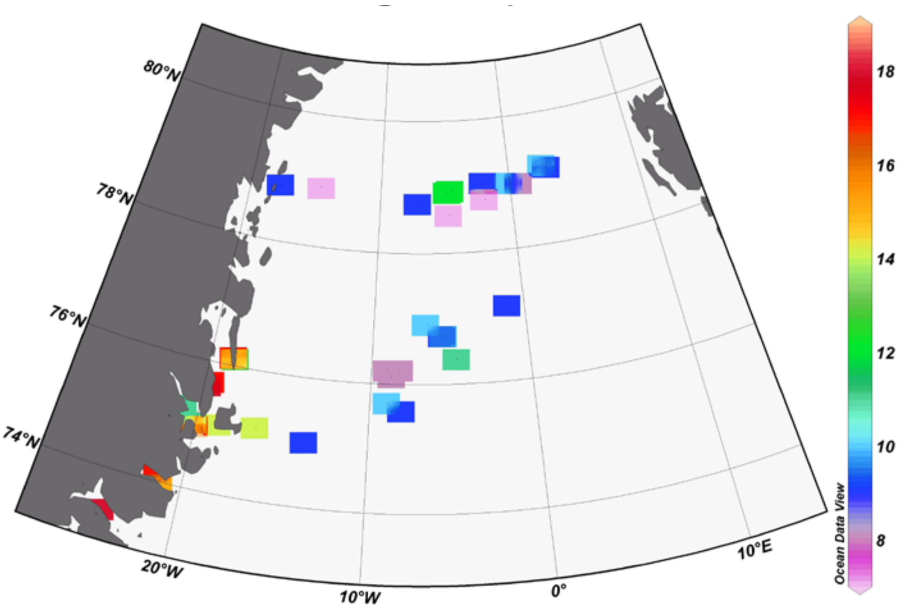


Figure 6.10 C/N-ratios in *Onshore Zone* and *Sea-Ice Zone* sediments of the East Greenland continental margin.

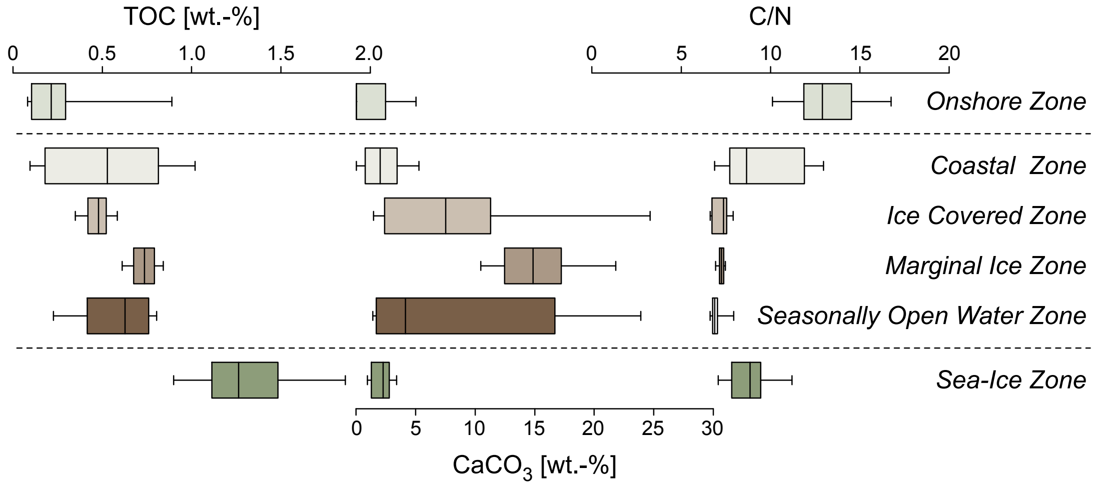


Figure 6.11 Box plots of TOC and carbonate (both in wt.-%), and C/N-ratios in sediment samples of the different zones. For zone assignment of samples see Chapter 6.1.

To account for the immature organic carbon in the young sediments and to determine the 'dead carbon' content the genetic potential (S1+S2) was plotted versus TOC (see Chapter 3.1.2). In *Onshore Zone* and *Sea-Ice Zone* samples the estimated 'dead carbon' content is 0.10 and 0.68 wt.-%, respectively. In contrast no 'dead carbon' is observed in the *Coastal Zone*, *Ice Covered Zone*, *Marginal Ice Zone* and *Seasonally Open Water Zone* (Appendix B). Using the estimated 'dead carbon' content the modified hyrogen indicies (HI(S1+S2)') are determined.

The modified hyrogen indicies in marine samples ranges between 44 and 273 mg HC/g TOC. In general samples south of 71°N show a regular distribution and higher values ranging between 120 and 200 mg HC/g TOC whereas samples north of 71°N have lower values (50-120 mg HC/g TOC) and a more irregular distribution (Figure 6.12; Table 6.1).

HI(S1+S2)' values in the *Onshore Zone* and *Sea-Ice Zone* are significantly higher (115-343 mg HC/g TOC and 175-597 mg HC/g TOC). Their distribution shows no noticeable pattern (Figure 6.13; Table 6.1)

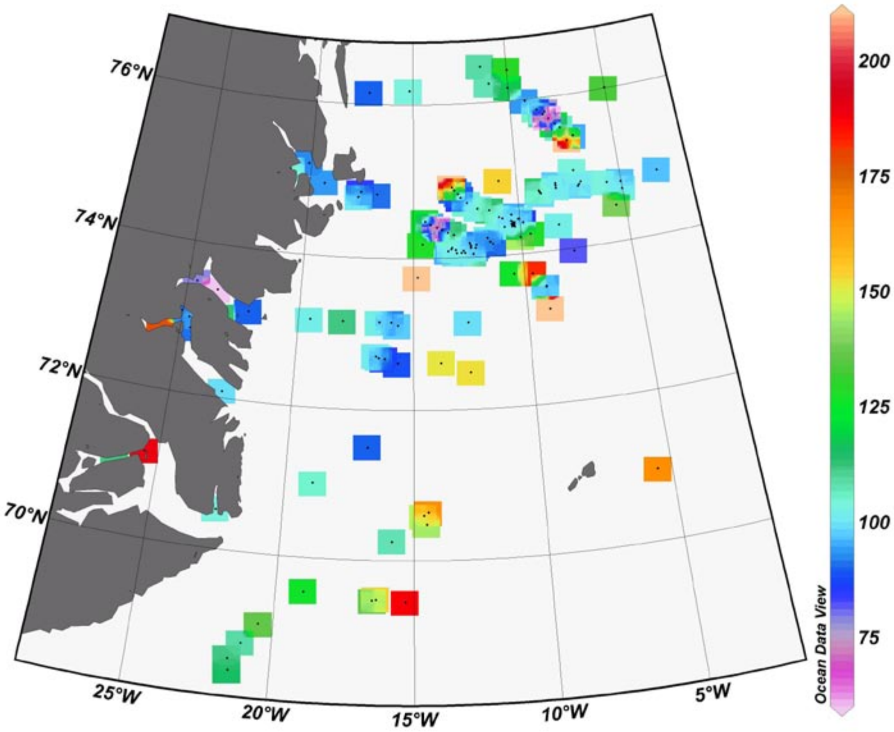


Figure 6.12 Modified hydrogen indicies (HI(S1+S2)‘) (in mg HC/g TOC) in marine surface sediments of the East Greenland continental margin.

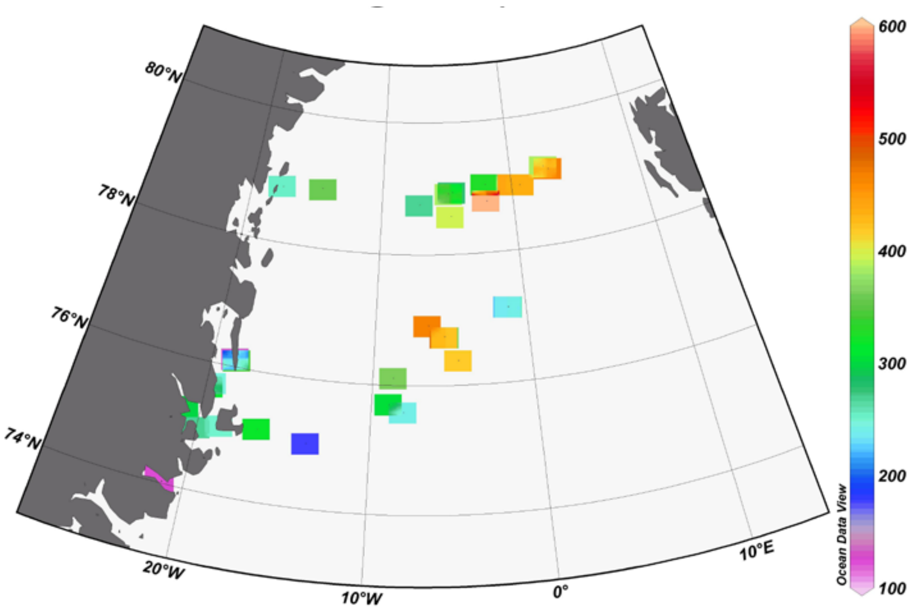


Figure 6.13 Modified HI (HI(S1+S2)‘) (in mg HC/g TOC) in *Onshore Zone* and *Sea-Ice Zone* sediments of the East Greenland continental margin.

Oxygen indicies in marine samples cover a wide range between 201 and 1026 mg CO_2/g TOC and the distribution shows a distinct east-west gradient. While fjord and shelf sediments are characterised by lower OI values (up to 400 mg CO_2/g TOC) slope and deep-sea samples have OIs above 400 mg CO_2/g TOC (Figure 6.16). In general, OI values increase from the *Coastal Zone* (348 mg CO_2/g TOC) over the *Ice Covered Zone* (412 mg CO_2/g TOC) towards the *Marginal Ice Zone* (478 mg CO_2/g TOC) and the *Seasonally Open Water Zone* (484 mg CO_2/g TOC). Samples of the *Marginal Ice Zone* show lowest variability in OI (SD=50) whereas the *Seasonally Open Water Zone* samples have a much higher variability (SD=209 mg CO_2/g TOC) (Figure 6.14; Table 6.1).

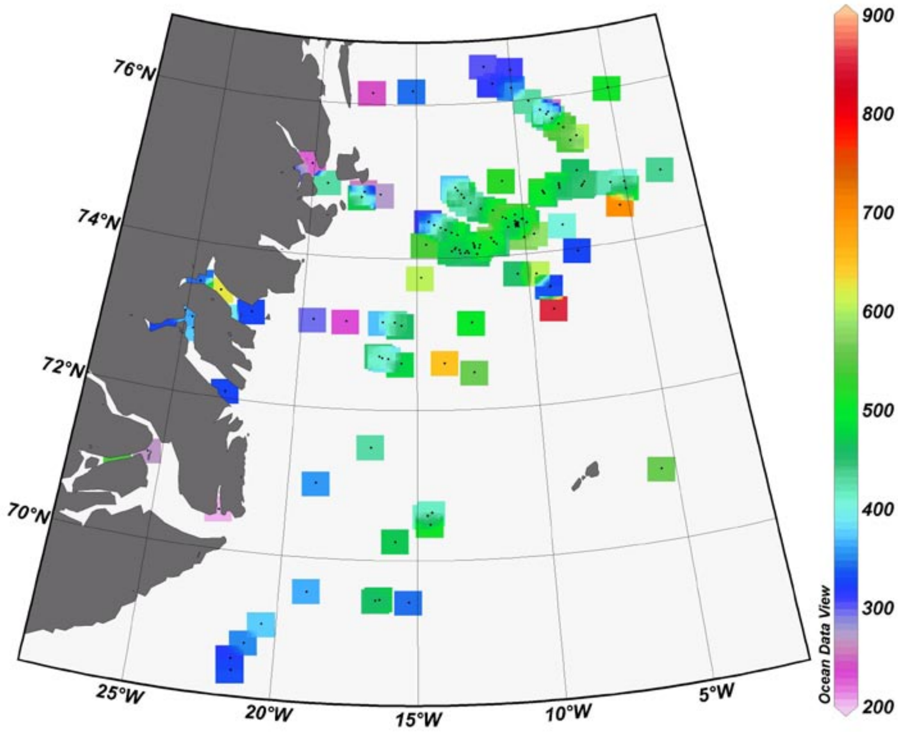


Figure 6.14 Oxygen indicies (in mg CO_2/g TOC) in marine surface sediments of the East Greenland continental margin.

In non-marine samples significant lower OI values are measured. In *Onshore Zone* and *Sea-Ice Zone* sediments the OI only reaches values between 127 and 404 mg CO_2/g TOC and 136 and 395 mg CO_2/g TOC, respectively. The measured values are regular distributed excepting outliners (Figure 6.15, Table 6.1).

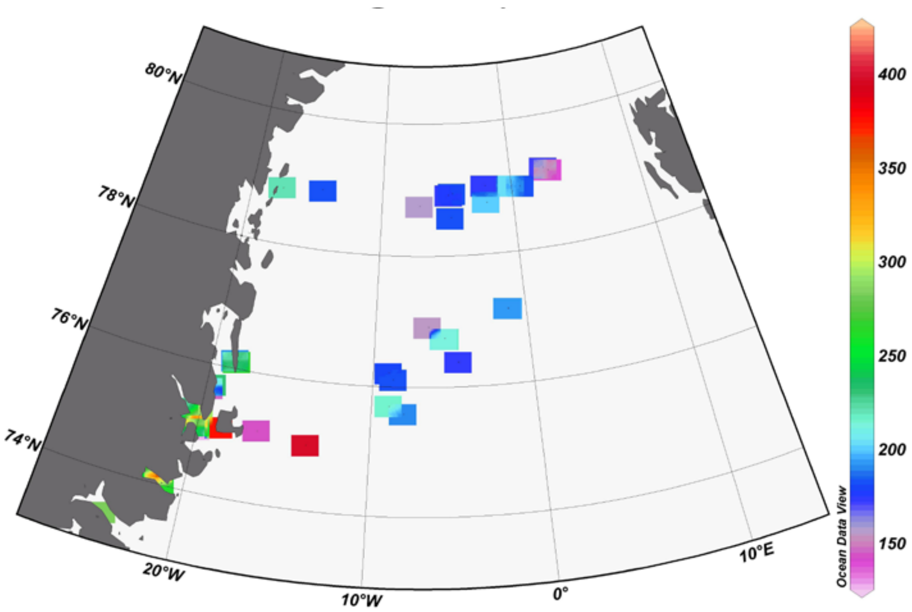


Figure 6.15 Oxygen indicies (in mg CO_2/g TOC) in *Onshore Zone* and *Sea-Ice Zone* sediments of the East Greenland continental margin.

The peak temperature T_{max} in marine samples ranges between 337 and 426°C . The distribution of T_{max} in samples shows a pattern with two temperature spans where the samples are located in. The first span ranges from 325 to 375°C and the second from 400 to 430°C (Figure 6.18). In general, inner fjord, outer shelf and upper slope samples and all samples south of 72°N are characterised by T_{max} values between 325 and 375°C but outliners occur. Sediments originating from near-coast shelf areas and the lower slope and deep-sea realm belong show values of the second temperature span between 400 and 430°C. *Marginal Ice Zone* sediments show only values of the higher temperature span between 400 and 430°C. Samples of the other marine zones do not include only T_{max} values of one temperature span. (Figure 6.16; Table 6.1).

Values of T_{max} in non-marine samples range between 290 and 430°. Also in *Onshore Zone* and *Sea-Ice Zone* samples two T_{max} temperature spans are recognisable. The first span ranges around 290°C and the second span also covers the range between 400 and 430°C (Figure 6.18). All sea-ice sediments belong to the second span and have T_{max} values between 400 and 430°C while iceberg sediments are restricted to the first temperature span around 290°C (Figure 6.17; Table 6.1).

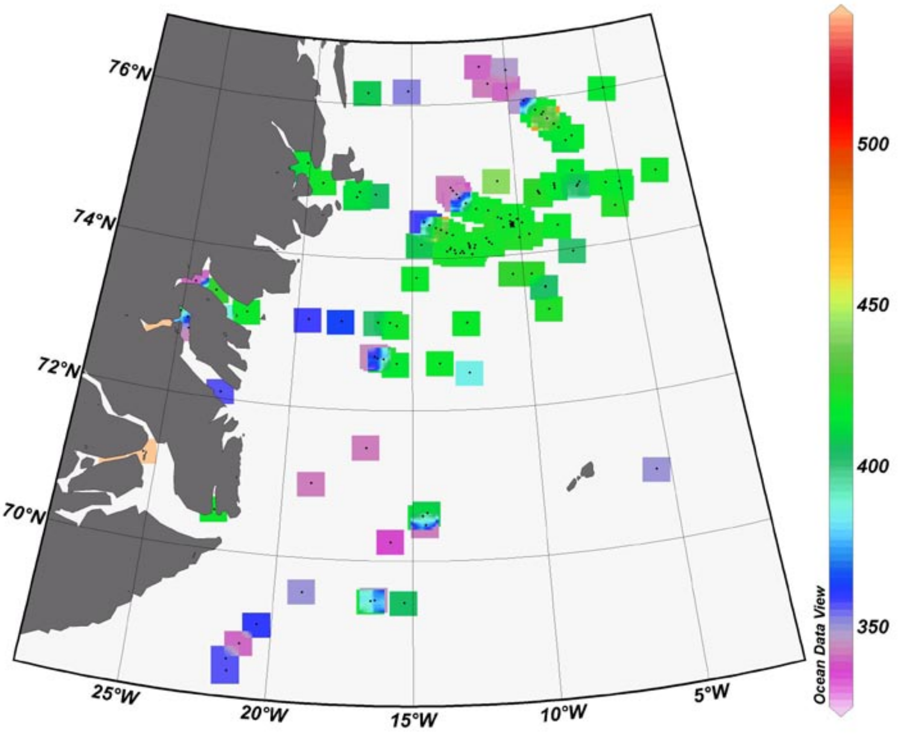


Figure 6.16 T_{max} (in °C) in marine surface sediments of the East Greenland continental margin.

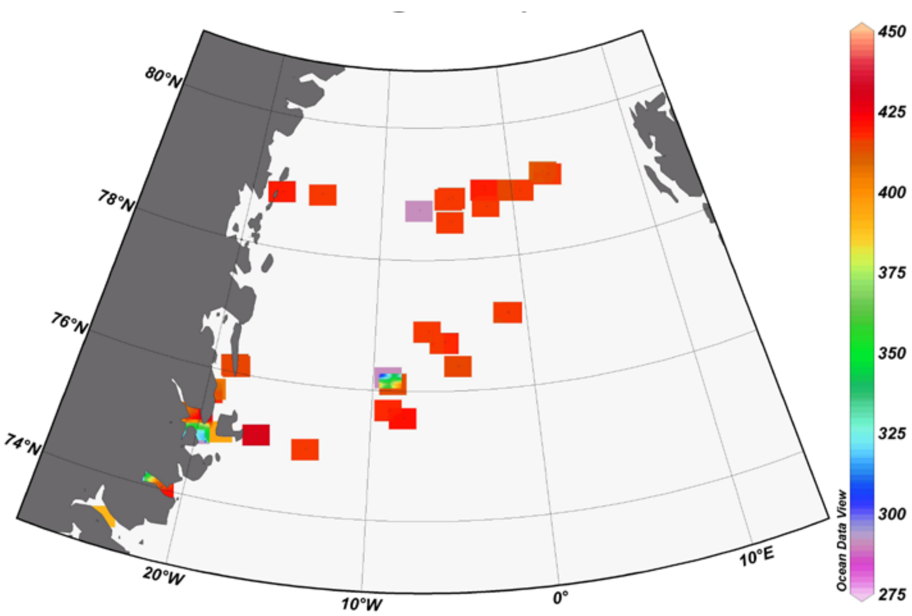


Figure 6.17 T_{max} (in °C) in *Onshore Zone* and *Sea-Ice Zone* sediments of the East Greenland continental margin.

While the main part of all marine samples belong in a HI versus T_{max} plot to kerogen type IV, the pattern change in a HI(S1+S2)' versus T_{max} plot. Using this diagram shows that the main part of the samples of all marine sub-groups belong more likely to kerogen type III. The higher HI and HI(S1+S2)' values of the non-marine sub-groups *Onshore Zone* and *Sea-Ice Zone* and their graphical presentation in a HI and HI(S1+S2)' versus T_{max} plot result in a predominant assignment of these samples to a mixture of kerogen type II and III (Figure 6.18).

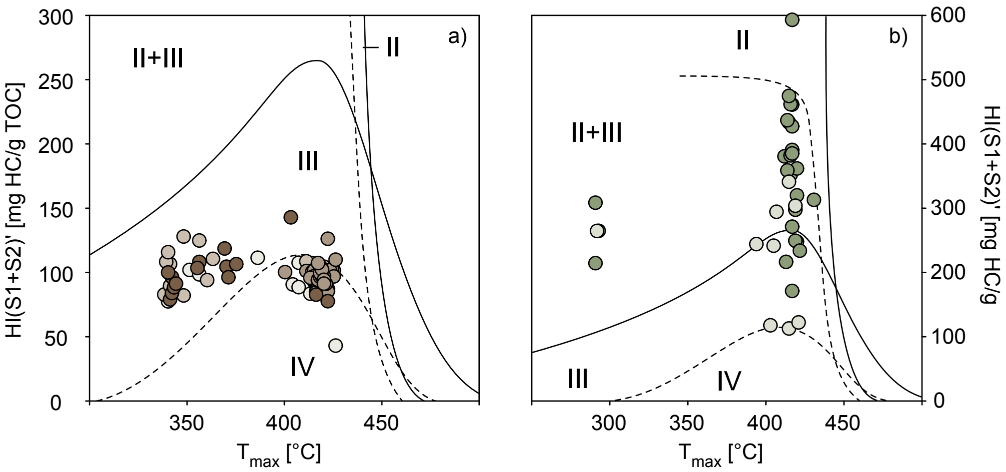


Figure 6.18 Plot of modified hydrogen indicies (HI(S1+S2)' in µg HC/g TOC) versus T_{max} (in °C) in sediment samples of the different zones **a)** *Coastal Zone*, *Ice Covered Zone*, *Marginal Ice Zone* and *Seasonally Open Water Zone* and **b)** *Onshore Zone* and *Sea-Ice Zone*. For zone assignment of samples and colour code see Chapter 6.1 and Figure 6.11, respectively.

6.3 Biomarkers in Modern Sediments

Due to analytical problems (coelution) *n*-alkohols in all investigated samples and sterols in sea-ice samples are not evaluated. Therefore sterols are missing in the sum of the absolute and relative concentrations of all detected and evaluated biomarkers and values are underrepresented. Both absolute concentrations and relative concentrations of all components in sea-ice samples show no noticeable distribution patterns. Therefore it has been refused to present the distributions of sea-ice components in maps.

The absolute concentrations of all detected and evaluated biomarkers in marine surface sediments range between 3.45 and 60.70 µg/g Sed. while their relative concentrations vary between 1915 and 12987 µg/g TOC (Table 6.2). In general, the absolute concentrations are in the range between 5 and 40 µg/g Sed. and the sample with a maximum absolute concentration of 60.70 µg/g Sed. can be regarded as an outliner. In the *Coastal Zone* the absolute concentrations show highest variability (SD=13.62 µg/g Sed.) and no general trend is obvious. The inner shelf area is characterised by highest absolute concentrations (25-40 µg/g Sed.). The absolute concentrations decrease in samples of the *Ice Covered Zone* to values between 10 and 15 µg/g Sed. (Mean= 14.25 µg/g Sed.) before the values increase again in the *Marginal Ice Zone* (Mean=19.67 µg/g Sed.) and the *Seasonally Open Water Zone* (Mean=17.11 µg/g Sed.) (Figure 6.19a). The distribution of relative concentrations of all biomarkers shows a similar pattern. The relative concentrations in *Coastal Zone* samples, especially in those originating from the fjords, show the highest variability (3260 µg/g Sed.) and maximum values (up to 13000 µg/g TOC). In contrast to absolute concentrations, the relative concentrations in inner shelf samples (3000-6000 µg/g TOC) are not those clear higher than relative concentrations in sediments of the other marine zones (2000-4000 µg/g TOC) (Figure 6.19b).

The absolute concentrations of all biomarkers in *Sea-Ice Zone* samples are up to ten times higher than those in marine samples even though the sterols are missing in the sum. Their absolute concentrations range between 38.53 and 895.82 µg/g Sed.. The relative concentrations show values between 2657 and 51731 µg/g TOC and thus they are up to five times higher than those in marine samples (Table 6.2).

Table 6.2 Mean, minimum (min.), maximum (max.) and standard deviation (SD) of *n*-alkanes, fatty acids, sterols and total biomarkers (µg/g Sed. and µg/g TOC) and CPI and fatty acid-ratios in sediment samples of the different zones. For zone assignment of samples and group assignment of biomarkers see Chapter 3.3 and 6.1, respectively. n = number of samples included.

	Coastal Zone (n=19)				*Ice Covered Zone* (n=20)				*Marginal Ice Zone* (n=54)				*Seasonally Open Water Zone* (n=15)				*Sea-Ice Zone* (n=16)			
	mean	min.	max.	SD	mean	min.	max.	SD	mean	min.	max.	SD	mean	min.	max.	SD	mean	min.	max.	SD
n-Alkanes																				
Total (µg/g Sed.)	1.12	0.16	2.75	0.88	1.20	0.39	2.04	0.56	2.68	0.75	3.88	0.57	1.40	0.22	2.51	0.72	15.31	8.19	27.86	6.27
Total (µg/g TOC)	226	101	716	142	252	118	421	98	369	250	590	72	226	99	319	68	1055	565	1910	413
Σ assigned to A (µg/g Sed.)	0.17	0.02	0.52	0.17	0.11	0.05	0.26	0.06	0.22	0.06	0.75	0.10	0.13	0.03	0.24	0.07	1.30	0.36	3.09	0.83
Σ assigned to A (µg/g TOC)	30	7	69	18	24	11	49	11	30	14	118	15	22	10	44	10	82	21	186	46
Σ assigned to C (µg/g Sed.)	0.38	0.06	1.32	0.30	0.49	0.16	0.90	0.22	1.12	0.31	1.49	0.24	0.60	0.07	1.07	0.32	4.95	1.45	8.28	2.02
Σ assigned to C (µg/g TOC)	82	40	344	68	102	54	186	39	154	97	215	29	94	32	133	30	345	100	575	135
CPI	3.4	2.1	4.7	0.7	4.2	3.5	5.0	0.4	4.2	1.3	4.7	0.5	4.0	2.7	4.6	0.5	4.1	3.1	5.1	0.5
Fatty Acids																				
Total (µg/g Sed.)	20.47	2.72	55.18	12.40	11.02	6.09	33.98	6.00	14.26	3.56	21.71	3.17	13.35	3.99	31.48	7.50	315.36	30.34	867.96	282.63
Total (µg/g TOC)	5048	1408	11107	2934	2387	1270	5525	1055	1963	1271	3109	386	2307	1251	5087	980	20546	2092	50808	16462
Σ assigned to A (µg/g Sed.)	10.31	0.79	34.89	8.25	3.71	1.45	18.30	3.68	3.38	0.61	5.55	0.95	4.18	1.15	14.34	3.48	166.60	4.67	379.24	140.89
Σ assigned to A (µg/g TOC)	2341	479	6244	1634	798	280	2975	626	465	217	951	128	727	215	2317	529	11198	322	32693	9276
Σ assigned to B (µg/g Sed.)	3.85	0.65	6.71	1.72	2.73	1.44	6.76	1.31	3.30	0.89	5.65	0.86	3.47	1.11	7.55	1.95	27.61	6.95	79.07	21.05
Σ assigned to B (µg/g TOC)	1047	321	2386	675	605	278	1191	288	454	311	788	106	607	220	1220	270	1831	550	4949	1282
Σ assigned to C (µg/g Sed.)	0.92	0.09	2.66	0.66	1.32	0.56	2.28	0.51	2.96	0.77	4.56	0.65	1.83	0.42	2.95	0.74	11.06	1.99	33.21	7.80
Σ assigned to C (µg/g TOC)	221	13	692	145	279	160	427	78	407	270	627	79	311	180	413	64	714	137	1313	343
16:1/16:0-ratio	1.6	0.2	2.7	0.7	0.9	0.7	1.7	0.3	0.9	0.6	1.2	0.1	0.9	0.6	1.6	0.2	1.9	0.5	3.5	1.1
18:1/18:0-ratio	6.8	1.9	11.1	2.9	6.0	2.6	9.9	2.0	4.0	2.0	7.9	1.0	5.7	2.7	10.1	1.8	8.3	2.1	19.3	4.6
Sterols																				
Total (µg/g Sed.)	3.22	0.53	12.06	2.55	2.03	0.76	3.77	0.74	2.73	1.24	5.64	0.88	2.36	1.39	5.47	1.18				
Total (µg/g TOC)	826	234	2100	562	450	158	800	184	376	174	725	108	436	199	1000	211				
Σ assigned to A (µg/g Sed.)	0.55	0.12	2.07	0.43	0.43	0.12	0.78	0.15	0.56	0.21	1.22	0.20	0.48	0.17	1.44	0.31		no data		
Σ assigned to A (µg/g TOC)	141	42	350	94	96	26	172	38	77	39	167	25	80	44	155	28				
Σ assigned to C (µg/g Sed.)	1.14	0.19	2.99	0.70	0.80	0.27	1.20	0.24	1.19	0.52	2.71	0.46	0.83	0.42	1.77	0.36				
Σ assigned to C (µg/g TOC)	304	89	913	218	177	56	305	60	164	71	329	57	148	91	215	40				
Total Biomarkers																				
Total (µg/g Sed.)	24.81	3.45	60.70	13.62	14.25	8.13	37.75	6.27	19.67	5.65	30.36	4.17	17.11	6.28	37.06	8.87	330.66	38.53	895.82	286.62
Total (µg/g TOC)	6100	1915	12987	3260	3088	1696	6137	1108	2708	1974	4114	485	2969	1775	5989	1086	21602	2657	51731	16655
Σ assigned to A (µg/g Sed.)	11.02	0.94	35.83	8.40	4.26	1.65	18.90	3.72	4.16	0.88	7.14	1.12	4.79	1.35	15.31	3.73	167.91	5.76	380.54	141.43
Σ assigned to A (µg/g TOC)	2511	576	6494	1650	917	345	3071	637	572	311	1079	146	829	282	2474	550	11280	397	32749	9296
Σ assigned to B (µg/g Sed.)	3.85	0.65	6.71	1.72	2.73	1.44	6.76	1.31	3.30	0.89	5.65	0.86	3.47	1.11	7.55	1.95	27.61	6.95	79.07	21.05
Σ assigned to B (µg/g TOC)	1047	321	2386	675	605	278	1191	288	454	311	788	106	607	220	1220	270	1831	550	4949	1282
Σ assigned to C (µg/g Sed.)	2.44	0.47	4.73	1.19	2.62	1.49	3.95	0.72	5.27	1.61	8.10	1.15	3.26	0.93	5.69	1.29	16.01	3.44	41.43	9.36
Σ assigned to C (µg/g TOC)	607	246	1417	324	558	398	739	96	726	453	1109	133	553	412	613	73	1058	237	1743	427

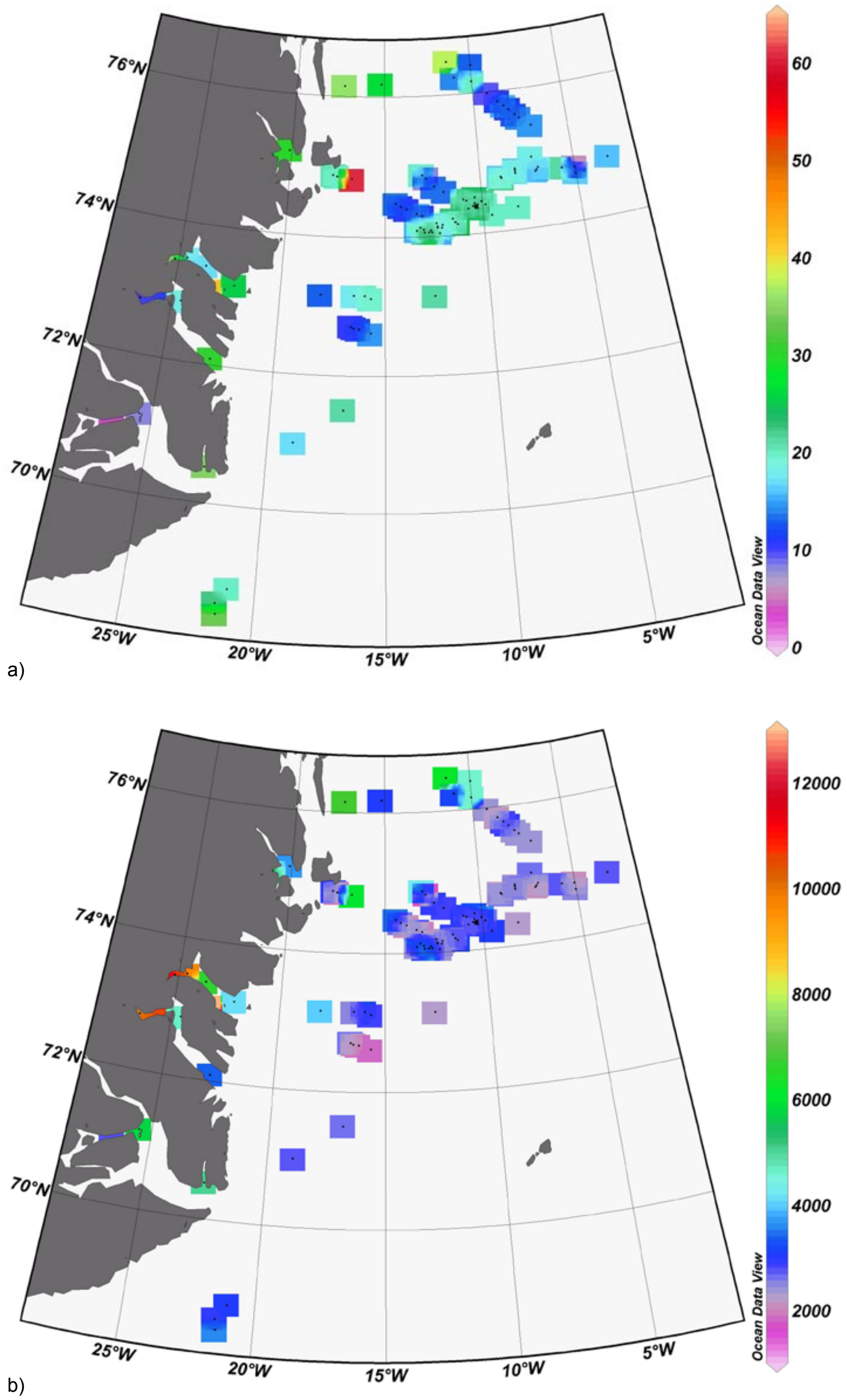


Figure 6.19 Concentrations of biomarkers **a)** in µg/g Sed. and **b)** in µg/g TOC in marine surface sediments of the East Greenland continental margin.

The sum of the short-chain *n*-alkanes C_{15}, C_{17}, and C_{19} (assigned to group A) is the component class with the lowest absolute (0.01-0.75 µg/g Sed.) and relative (7-118 µg/g TOC) concentrations of all investigated biomarkers (Table 6.2). In general the absolute concentrations are lowest in *Ice Covered Zone* and *Seasonally Open Water Zone* samples (Mean=0.11 and 0.13 µg/g Sed.) and they increase in *Marginal Ice Zone* samples (Mean=0.22 µg/g Sed.) where an distinct area is characterised by sligthly higher values (0.20-0.35 µg/g Sed.). The *Coastal Zone* shows highest variability (SD=0.17 µg/g Sed.) (Figure 6.20a). Relative concentrations have a similar distribution pattern like the absolute concentrations. The lowest relative concentrations are also measured in *Ice Covered Zone* and *Seasonally Open Water Zone* samples (Mean=24 and 24 µg/g TOC) and values increase towards the *Coastal Zone* (7-69 µg/g TOC) and the *Marginal Ice Zone* (14-118 µg/g TOC) (Figure 6.20b).

In general, the concentrations of short-chain *n*-alkanes in *Sea-Ice Zone* sediments are only five (absolute) and two (relative) times higher, respectively (Table 6.2). The absolute concentrations reach values between 0.3 and 3.0 µg/g Sed. while the relative amounts vary between 20 and 200 µg/g TOC. The sample with maximum absolute and relative concentrations can be regarded as an outliner.

The absolute and relative concentrations of the sum of the long-chain *n*-alkanes C_{27}, C_{29}, C_{31}, and C_{33} (assigned to group C) vary between 0.06 and 1.49 µg/g Sed. and 32 and 452 µg/g TOC, respectively (Table 6.2). Both show clear gradients in distribution. The absolute and relative concentrations of long-chain *n*-alkanes in *Coastal Zone* and *Seasonally Open Water Zone* sediments are highly variable (0.06-1.32 µg/g Sed. and 0.07-1.07 µg/g Sed.) but generally low. The absolute concentrations reach lowest values in fjord sediments (0-0.3 µg/g Sed.) whereas relative concentrations reach lowest values (40-120 µg/g TOC) in inner shelf sediments. Both concentrations increase in *Ice Covered Zone* sediments (0.5-0.7 µg/g Sed. and 100-150 µg/g TOC) and maximum values occur in *Marginal Ice Zone* sediments between 73 and 75°N (1.0-1.5 µg/g Sed. and 130-220 µg/g TOC). (Figure 6.21a, b).

The absolute and relative amounts of long-chain *n*-alkanes in *Sea-Ice Zone* sediments range between 0.69 and 8.28 µg/g Sed. and 74 and 575 µg/g TOC, respectively (Table 6.2).

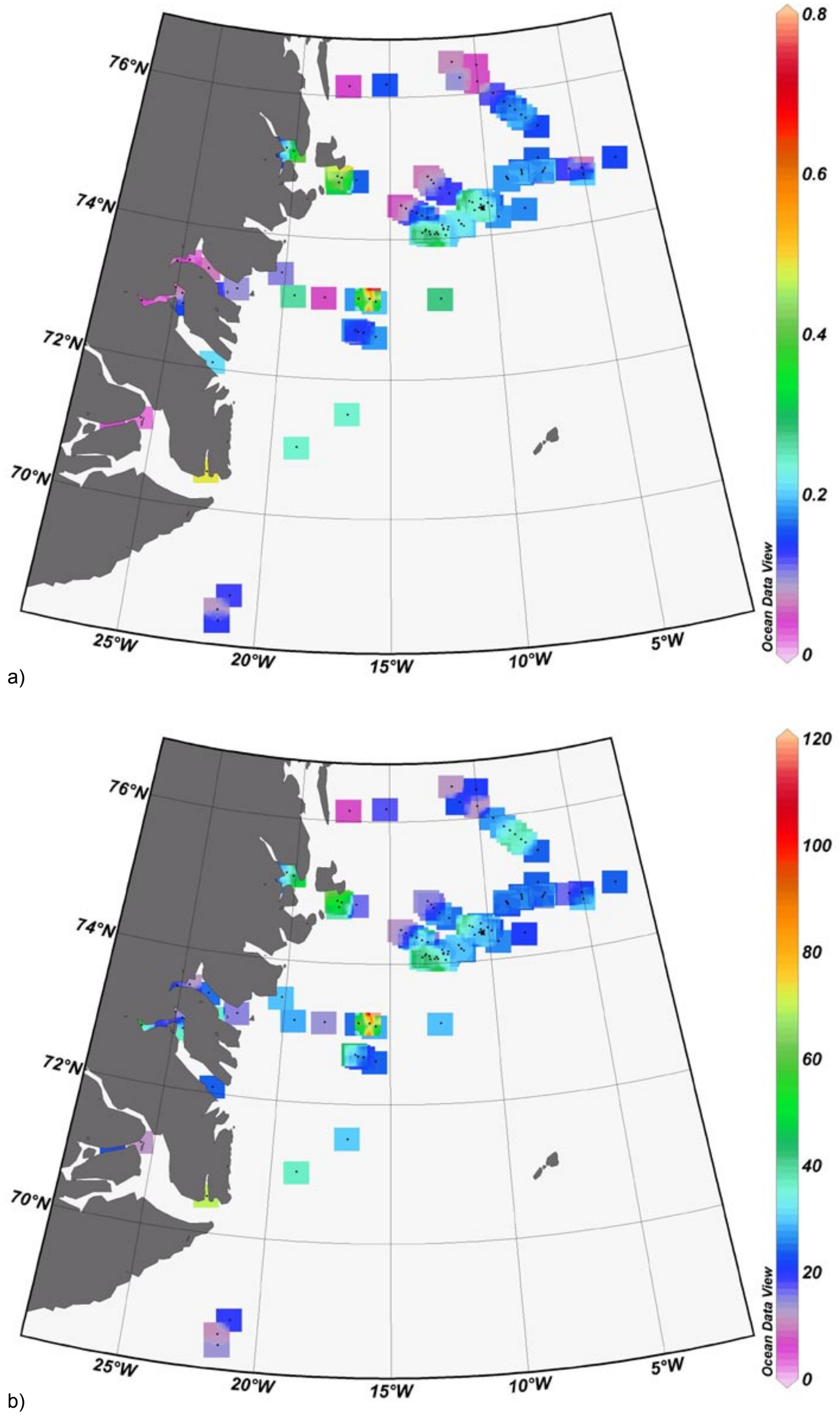
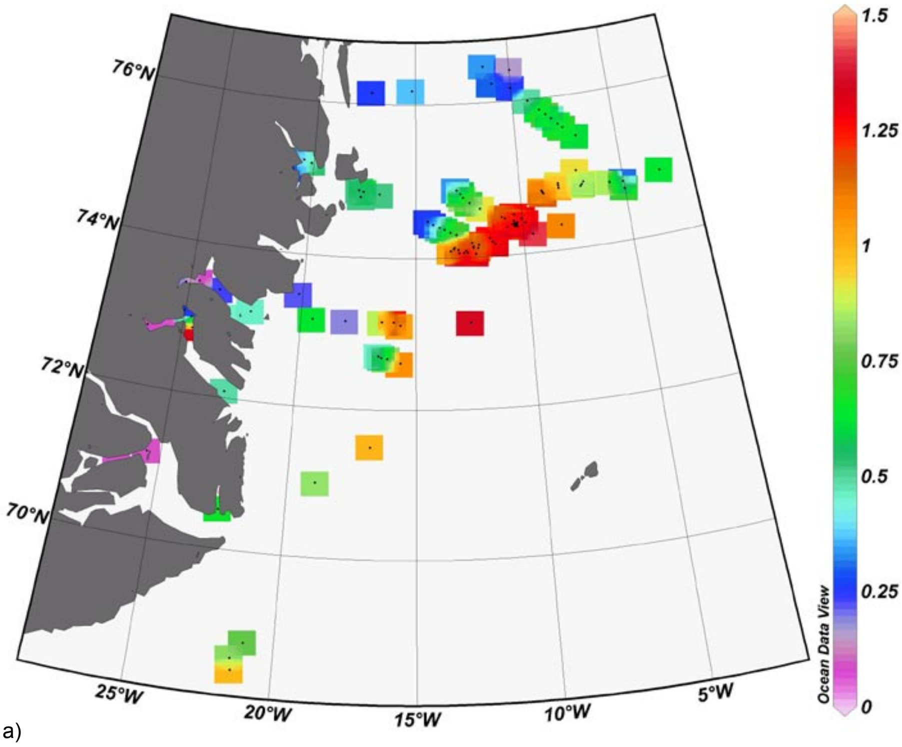
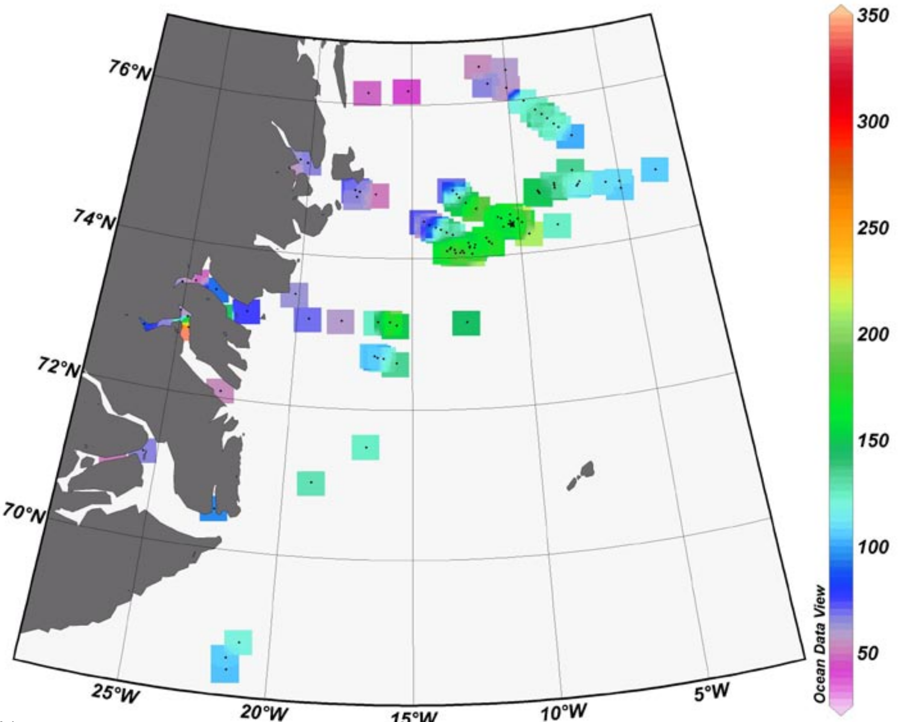


Figure 6.20 Concentrations of short-chain *n*-alkanes **a)** in µg/g Sed. and **b)** in µg/g TOC in marine surface sediments of the East Greenland continental margin.



a)



b)

Figure 6.21 Concentrations of long-chain *n*-alkanes **a)** in µg/g Sed. and **b)** in µg/g TOC in marine surface sediments of the East Greenland continental margin.

The CPIs in marine samples vary in a range between 2 and 5 (Table 6.2). In general, *Ice Covered Zone*, *Marginal Ice Zone* and *Seasonally Open Water Zone* sediments are characterised by a CPI of 4.5 whereas *Coastal Zone* sediments have a mean CPI of 3.5. In the inner Kejser Franz Joseph Fjord and the inner Kong Oscar Fjord the CPI increases up to 4.5(Figure 6.22). The *Sea-Ice Zone* is generally characterised by a CPI of 4 (Table 6.2).

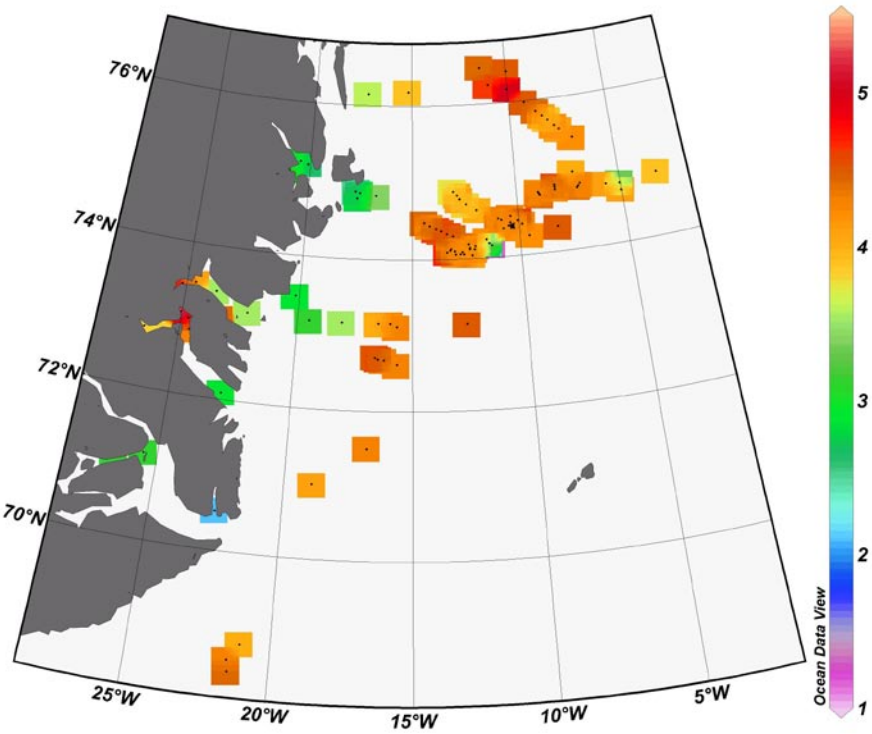


Figure 6.22 CPI in marine surface sediments of the East Greenland continental margin.

The sum of algae-specific fatty acids (assigned to group A) has highest absolute and relative concentrations of all investigated biomarkers and varies between 0.79 and 34.89 µg/g Sed. and 215 and 7083 µg/g TOC (Table 6.2). In general highest concentrations, absolute as well as relative, occur in the northwestern sediments (10-35 µg/g Sed. and 2500-5000 µg/g TOC) and values decrease significantly to the Southwest (1-5 µg/g Sed. and 200-2000 µg/g TOC). *Coastal Zone* sediments show a high variability (SD=8.25 µg/g Sed.) while sediments of the other zones show consistent values (SD=3.68, 0.95 and 3.48 µg/g Sed.) (Figure 6.23a, b).

Values of algae-specific fatty acids in *Sea-Ice Zone* sediments have clearly higher concentrations. Absolute concentrations in *Sea-Ice Zone* sediments are up to ten times higher than those in marine sediments (4.67-379.24 µg/g Sed.). The relative amounts are five times higher (322-32693 µg/g TOC).

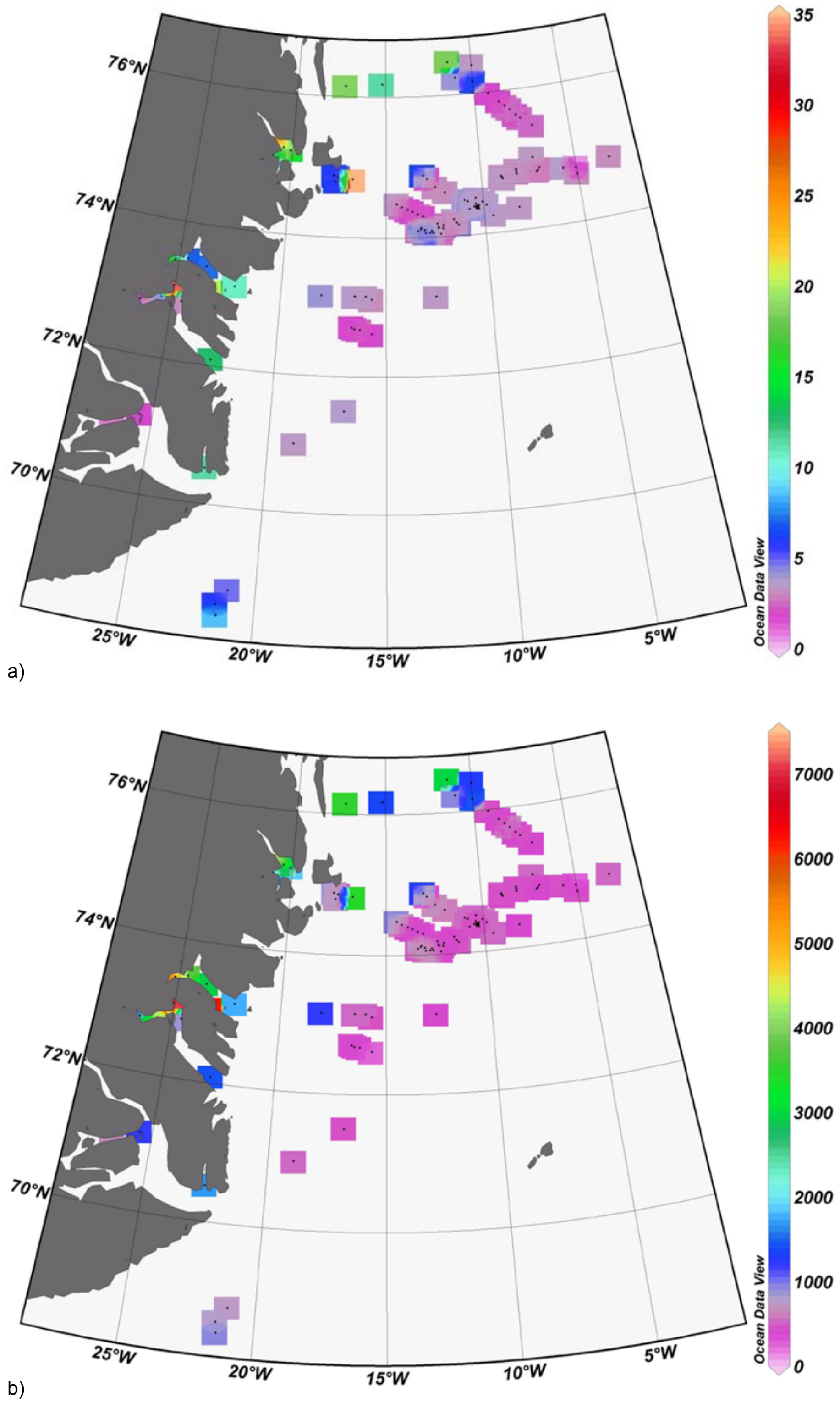


Figure 6.23 Concentrations of algae-specific fatty acids **a)** in µg/g Sed. and **b)** in µg/g TOC in marine surface sediments of the East Greenland continental margin.

Zooplankton- and bacteria-specific fatty acids (assigned to group B) occur in smaller amounts than algae-specific fatty acids but they represent also an important and abundant component class. They range between 0.65 and 8.31 µg/g Sed. (absolute) and 311 and 2386 µg/g TOC (relative) (Table 6.2). *Coastal Zone* samples show highest variability in both absolute and relative. The absolute concentrations are lowest in *Ice Covered Zone* sediments (1-3 µg/g Sed.) whereas *Marginal Ice Zone* and *Seasonally Open Water Zone* sediments are characterised by higher values (3-6 µg/g Sed.). In the distribution of relative concentrations a northwest-southeast gradient is developed. The values decrease from 1000-1500 µg/g TOC down to 300-800 µg/g TOC (Figure 6.24a, b).

As values of algae-specific fatty acids also values of zooplankton- and bacteria-specific fatty acids are significant higher in *Sea-Ice Zone* samples (6.95-79.07 µg/g Sed. and 550-4949 µg/g TOC) (Table 6.2).

The distribution of absolute and relative concentrations of long-chain fatty acids (assigned to group C) is similar to the distribution of long-chain *n*-alkanes. The absolute and relative values vary between 0.09 and 4.56 µg/g Sed. and 13 and 627 µg/g TOC, respectively (Table 6.2). *Coastal Zone* samples are generally low (Mean=0.92 µg/g Sed. and 221 µg/g TOC). The concentrations increase in *Ice Covered Zone* (Mean=1.32 µg/g Sed. and 279 µg/g TOC) and *Seasonally Open Water Zone* sediments (Mean=1.83 µg/g Sed. and 311 µg/gTOC) towards *Marginal Ice Zone* sediments (Mean=2.96 µg/g Sed. and 407 µg/g TOC) (Figure 6.25a, b).

Concentrations in the *Sea-Ice Zone* (absolute and relative) range between 1.99 and 33.21 µg/g Sed. and 137 and 1313 µg/g TOC, respectively (Table 6.2). They are therefore only five (absolute) and two (relative) times higher than the amounts of long-chain fatty acids in marine samples.

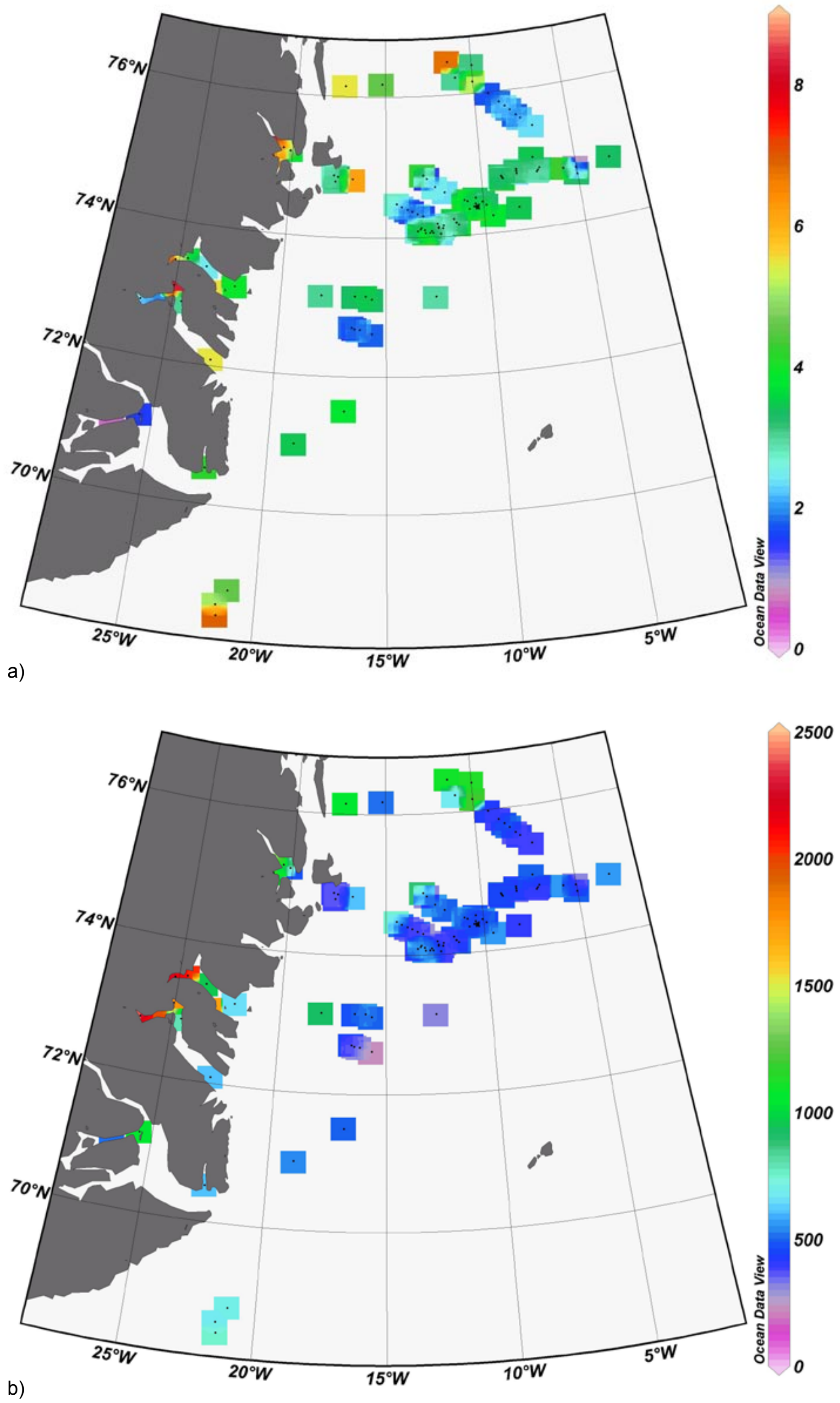


Figure 6.24 Concentrations of zooplankton- and bacteria-specific fatty acids **a)** in µg/g Sed. and **b)** in µg/g TOC in marine surface sediments of the East Greenland continental margin.

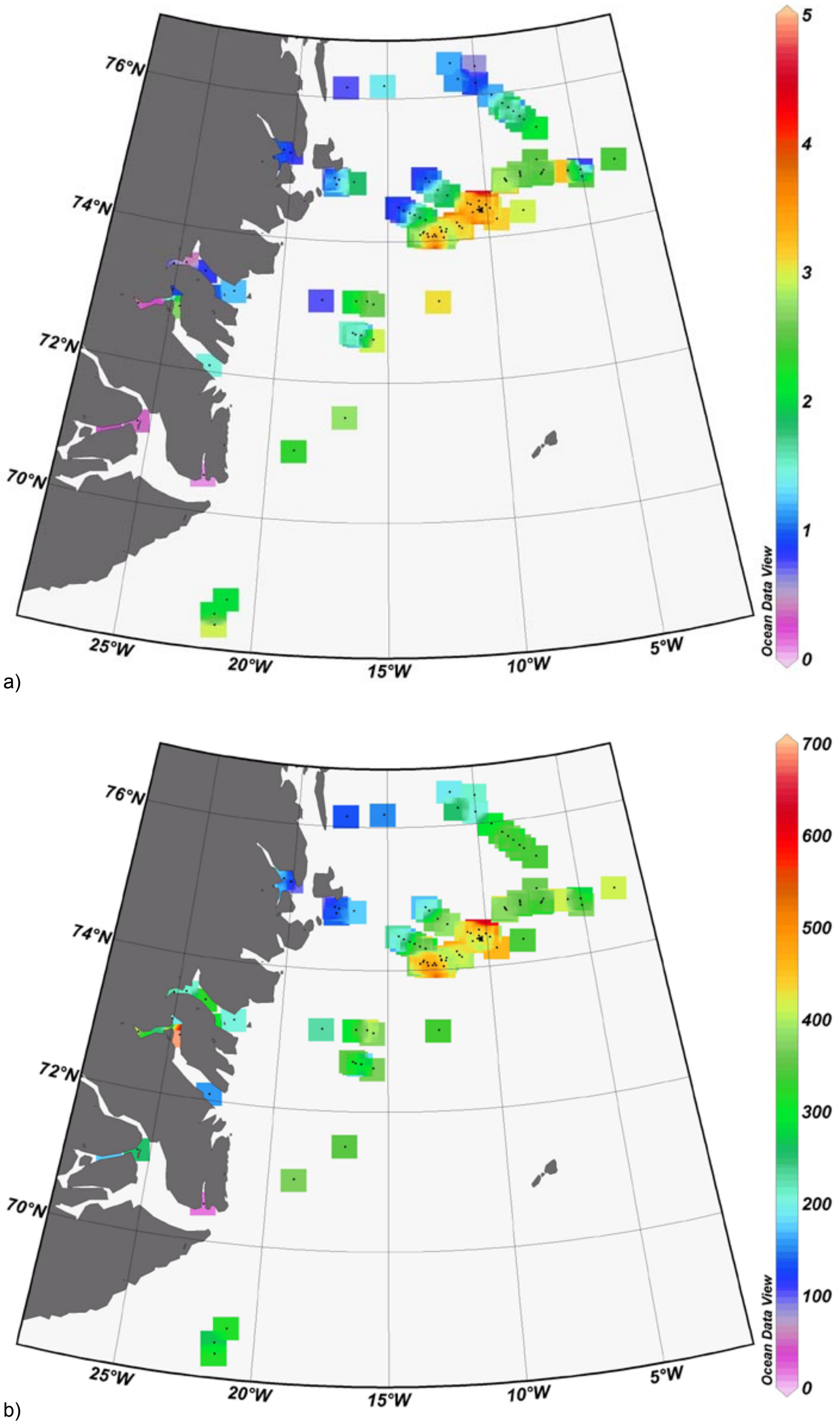


Figure 6.25 Concentrations of long-chain fatty acids **a)** in µg/g Sed. and **b)** in µg/g TOC in marine surface sediments of the East Greenland continental margin.

The 16:1/16:0-ratio in marine samples (0.2-2.7) shows a distinct northwest-southeast gradient (Table 6.2). Along this gradient the values decrease from maximum values in *Coastal Zone* sediments (1.5-2.7) towards a mean value of 0.9 in *Ice Covered Zone*, *Marginal Ice Zone* and *Seasonally Open Water Zone* sediments (Figure 6.26). In *Sea-Ice Zone* samples the 16:1/16:0-ratio is slightly higher and varies between 0.5 and 3.5 (Table 6.2).

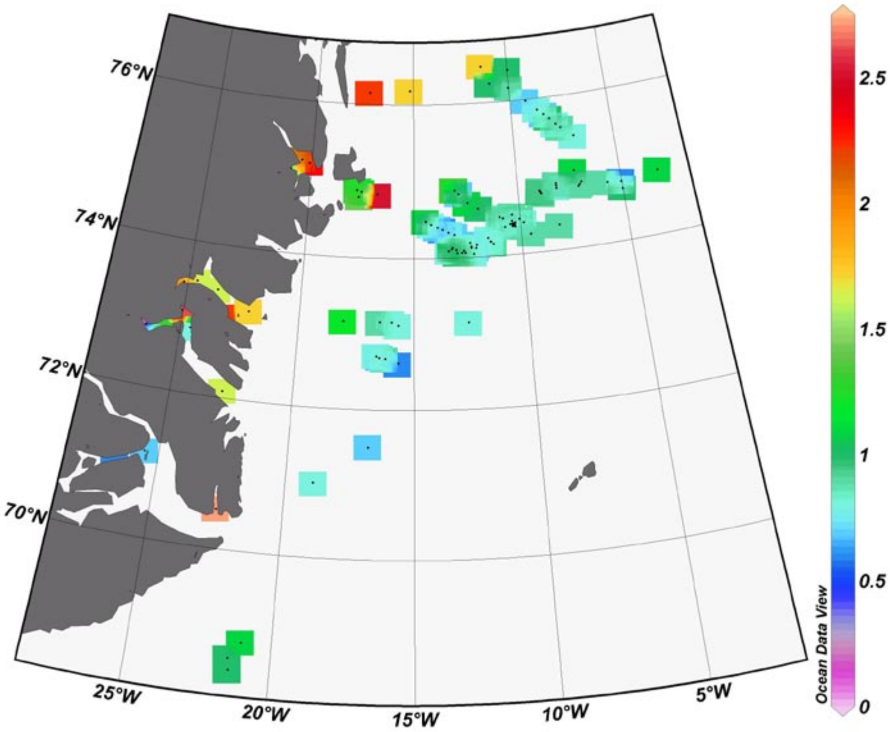


Figure 6.26 16:1/16:0-ratio in marine surface sediments of the East Greenland continental margin.

Values of the 18:1/18:0-ratio range between 1.9 and 11.1 in the marine zones and 2.1 and 19.3 in *Sea-Ice Zone* sediments (Table 6.2). The ratio shows a distribution pattern similar to the distribution of the 16:1/16:0-ratio but lowest values occur in *Marginal Ice Zone* sediments (Mean=4.0) (Figure 6.27).

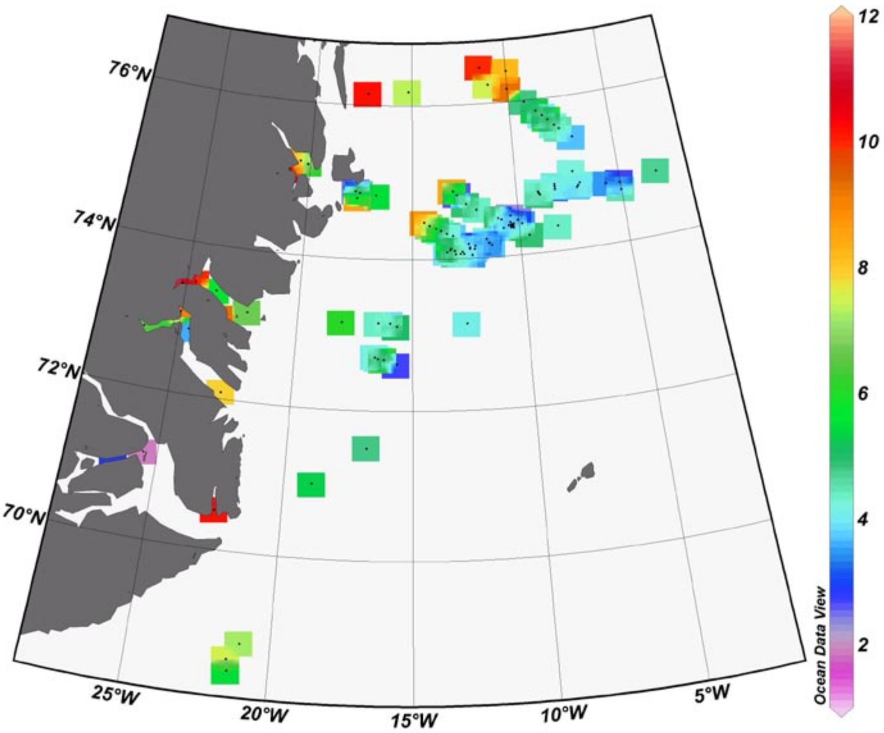


Figure 6.27 18:1/18:0-ratio in marine surface sediments of the East Greenland continental margin.

The absolute and relative concentrations of brassicasterol (assigned to group A) in marine sediment samples vary in the range between 0.12 and 2.07 µg/g Sed. and 39-350 µg/g TOC, respectively (Table 6.2). A distinct distribution pattern is not to be recognised and values range generally between 0.1 and 0.7 µg/g Sed. and 40 and 100 µg/g TOC. Locally higher values occur (Figure 6.28a, b).

Higher plant-specific sterols (assigned to group C) show absolute and relative concentrations between 0.19 and 2.99 µg/g Sed. and 56 and 913 µg/g TOC (Table 6.2). The distribution pattern of absolute concentrations is characterised by nearly constant values in *Coastal Zone* and *Marginal Ice Zone* sediments (Mean=1.14 and 1.19 µg/g Sed.) and slightly lower values in *Ice Covered Zone* and *Seasonally Open Water Zone* sediments (Mean=0.80 and 0.83 µg/g Sed.) (Figure 6.29a). Highest relative concentrations of higher plant-specific sterols are measured in *Coastal Zone* sediments (300-900 µg/g TOC). Sediments belonging to the other marine zones show only variations in a narrow range (50-250 µg/g TOC) (Figure 6.29b).

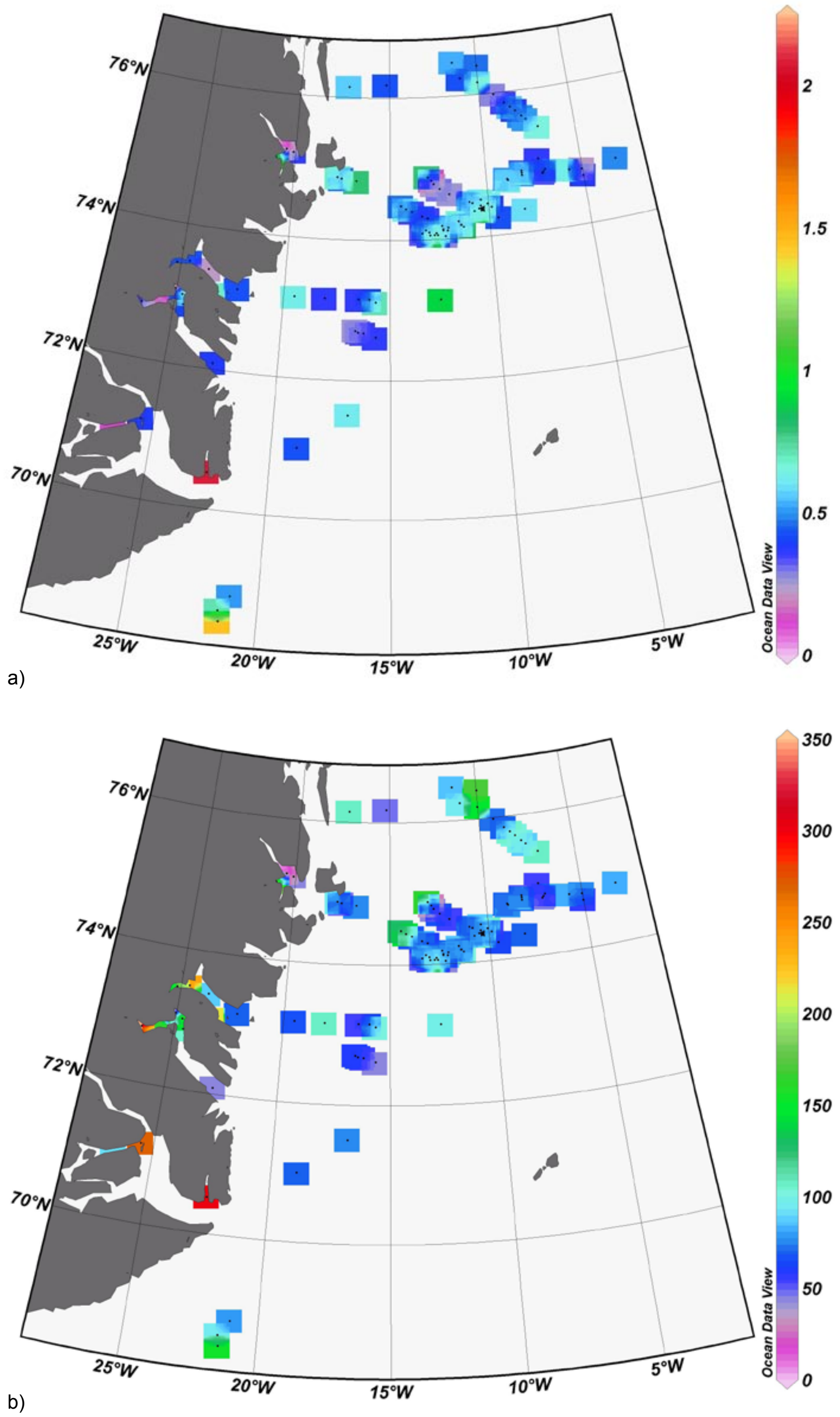


Figure 6.28 Concentrations of brassicasterol **a)** in µg/g Sed. and **b)** in µg/g TOC in marine surface sediments of the East Greenland continental margin.

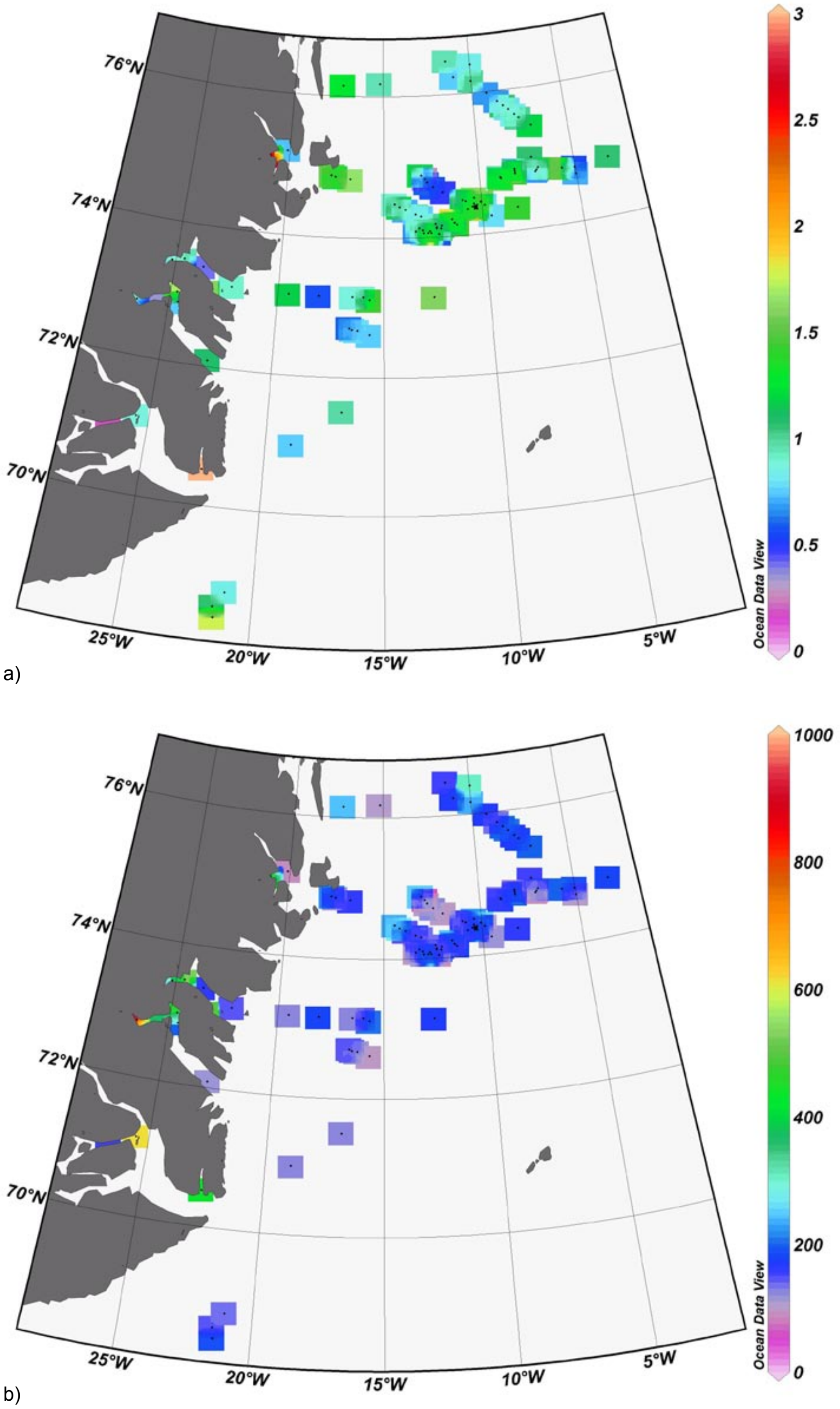


Figure 6.29 Concentrations of higher plant-specific sterols **a)** in µg/g Sed. and **b)** in µg/g TOC in marine surface sediments of the East Greenland continental margin.

6.4 Compound-Specific Carbon Isotope Analysis

Compound-specific stable carbon isotopic ratios are determined for *n*-alkanes of 11 selected samples by J. Hefter. The $\delta^{13}C$ values for all investigated compounds and stations are presented in Table 6.3. In the following the results of stable carbon isotopic measurements of one short-chain (C_{19}) and one long-chain (C_{29}) *n*-alkane in samples of the different marine zones are shown in detail (Figure 6.30). The $\delta^{13}C$ values of long-chain *n*-alkane C_{29} range from -33.6 to -29.1‰. Thereby the *Marginal Ice Zone* and *Seasonally Open Water Zone* samples are most depleted in ^{13}C, ranging between -33.2 and -33.0‰, while *Ice Covered Zone* and *Coastal Zone* samples show values between -33.6 and -30.8‰ and -31.1 and -29.1‰. The short-chain *n*-alkane C_{19} is less depleted in ^{13}C, ranging from -27.7 to -22.7‰. The *Coastal Zone*, *Marginal Ice Zone* and *Seasonally Open Water Zone* samples are characterised by a $\delta^{13}C$ range between -27.7 to -24.8‰ while *Ice Covered Zone* samples have $\delta^{13}C$ values of -22.7 to -21.6‰.

Table 6.3 $\delta^{13}C$ (‰ vs. VPDB) values for *n*-alkanes in surface sediments of the East Greenland continental margin (unpublished data J. Hefter). For zone assignment of samples see Chapter 6.1.

n-Alkane	Station	2620	2630	2631	2637	57/075	64/487	64/506	64/528	64/582	64/628	64/707
	Zone	CZ	ICZ	CZ	CZ	MIZ	CZ	ICZ	ICZ	ICZ	MIZ	SOWZ
16		-29.4	n.d.	n.d.	n.d.	-26.4	n.d.	-26.5	-24.4	-29.5	-26.1	-31.4
17		-27.8	n.d.	n.d.	-28.2	-27.0	n.d.	-26.2	-25.1	-30.9	-27.0	-30.8
18		-28.7	n.d.	n.d.	-26.2	-26.3	n.d.	-26.2	-25.2	-32.0	-27.1	-30.8
19		-27.5	n.d.	-27.7	-26.5	-27.7	n.d.	n.d.	-21.6	-22.7	-24.8	-26.2
20		-28.7	n.d.	-27.6	-26.6	-27.9	n.d.	-25.4	-26.9	-31.2	-27.8	-30.6
21		-28.3	n.d.	-27.8	-27.9	-29.0	n.d.	-27.5	-27.8	-30.8	-28.7	-31.2
22		-27.1	n.d.	-28.6	-28.1	-29.7	n.d.	-29.1	-29.5	-30.0	-29.1	-31.1
23		-28.1	n.d.	-28.6	-29.2	-30.1	n.d.	-29.5	-30.7	-30.4	-30.5	-30.8
24		-27.5	n.d.	-27.3	-29.5	-30.3	n.d.	-29.6	-29.6	-30.1	-30.6	-30.4
25		-28.1	-29.2	-30.6	-30.3	-30.5	-29.2	-30.9	-31.3	-30.4	-31.6	-31.0
26		-28.1	n.d.	-30.6	-29.8	-30.6	-29.9	-30.0	-29.3	-31.1	-31.2	-30.7
27		-28.9	-29.9	-30.1	-31.7	-32.5	-30.5	-31.1	-30.6	-32.4	-33.0	-32.2
28		-27.1	n.d.	-28.4	-30.1	-32.6	-31.2	-30.9	-29.5	-32.7	-31.1	-31.9
29		-29.1	-30.8	-30.1	-32.3	-33.0	-31.1	-33.6	-31.7	-33.1	-33.2	-33.2
30		n.d.	n.d.	n.d.	-32.4	-31.2	-29.2	n.d.	n.d.	-32.3	-28.1	-29.6
31		-29.5	-28.4	-31.2	-32.3	-32.6	-30.8	-31.5	-31.4	-31.1	-32.1	-33.0
33		n.d.	n.d.	-29.0	-30.9	-33.9	-29.6	n.d.	-29.1	-33.2	-32.7	-34.7

n.d. = no data

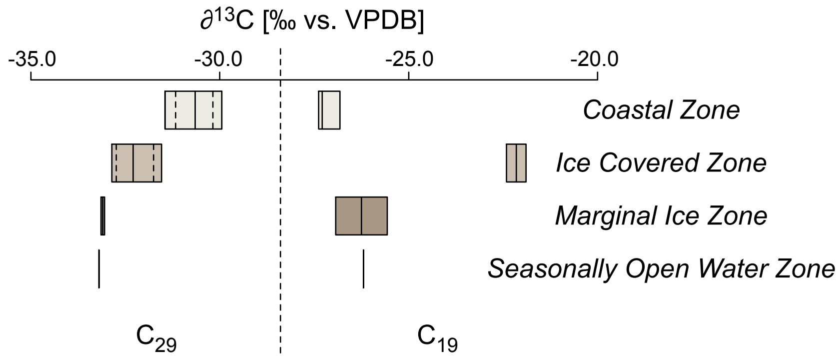


Figure 6.30 $\delta^{13}C$ (‰ vs. VPDB) values of long-chain *n*-alkane C_{29} and short-chain *n*-alkane C_{19} in surface sediments of marine zones of the East Greenland continental margin (unpublished data J. Hefter).

6.5 Organic-Geochemical Bulk Parameters in Sediments Cores

The very low concentrations of TOC and nitrogen in the investigated sediment core samples demand for great caution in interpreting C/N-ratios and results of Rock-Eval Pyrolysis (see Chapter 3.1). Because the measured nitrogen concentrations are next to the detection limit of the analyser the C/N-ratios only give an additional hint for interpretation but the discussion cannot be based on them. Therefore the C/N-ratios are not presented in this chapter but in Appendix A. The interpretation of Rock-Eval Pyrolysis data of TOC poor samples (<0.5 wt.-%) is problematic. Therefore, Rock-Eval Pyrolysis parameters were not determined on core samples.

The cores collected south of the Denmark Strait (PS62/003, PS62/004) differ in the mean values of TOC and carbonate contents from the cores north of the Denmark Strait (PS62/015, PS62/017, PS2644). The TOC values are generally lower in the southern cores whereas their carbonate contents are higher than those in the northern cores. General differences in mean C/N-ratios between the cores of the two sub-areas are not recognised. Carbonate contents and C/N-ratios increase with increasing water depth and distance to the coast (Figure 4.1). A general dependency of the measured parameters on affiliation to marine isotope stages is not to identify (Figure 6.31).

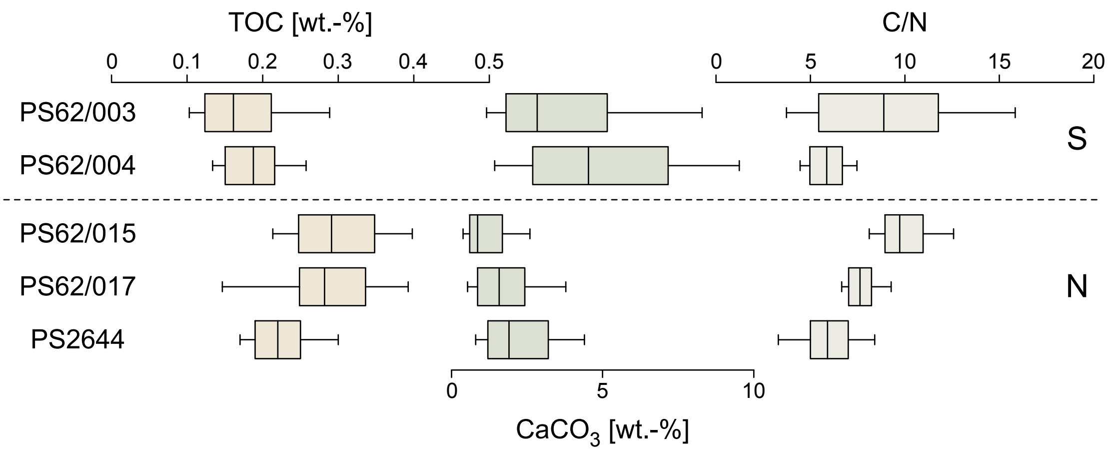


Figure 6.31 Box plots of TOC and carbonate content (both in wt.-%), and C/N-ratios in sediment cores.

6.5.1 PS62/003 (Figure 6.32)

The TOC content of core PS62/003 varies between 0.1 and 0.5 wt.-% around a mean value of 0.18 wt.-%. In five core sections the TOC values increase obviously above mean (100-150 cm, 210-240 cm, 340-375 cm, 610-855 cm, 1210-1240 cm). All these sections, with the exception of the section 610-855 cm, cumulate in a distinct maximum. The distribution of the TOC record in section 610-855 cm is characterised by a cyclic variability with generally higher TOC values. The main part of the core has generally low carbonate contents beneath the mean value of 4 wt.-%. The carbonate content reaches maximum values of 29 wt.-% in a section (470-550 cm) with generally increased carbonate contents. Only in three other sections (320-340 cm, 1055-1080 cm, 1130-1150 cm) peaks with carbonate contents above mean occur. Generally the increased carbonate values appear in sections with decreased TOC values.

6.5.2 PS62/004 (Figure 6.33)

The TOC content of core PS62/004 is also variable but the amplitudes of the variations are lower than those in core PS62/003. In general the values vary between 0.1 and 0.3 wt.-%. Thereby the mean (0.19 wt.-%) is slightly higher than the mean of core PS62/003. Altogether the whole record shows no distinct sections with minima or maxima. Carbonate values range between 0 and 14 wt.-% around a mean value of 5 wt.-%. The distribution of the values is highly variable and three sections (415-575 cm, 720-820 cm, 1080-1220 cm) with increased values, cumulating in maxima, appear. As described for core PS62/003 core PS62/004 has also increased carbonate values in sections with decreased TOC values.

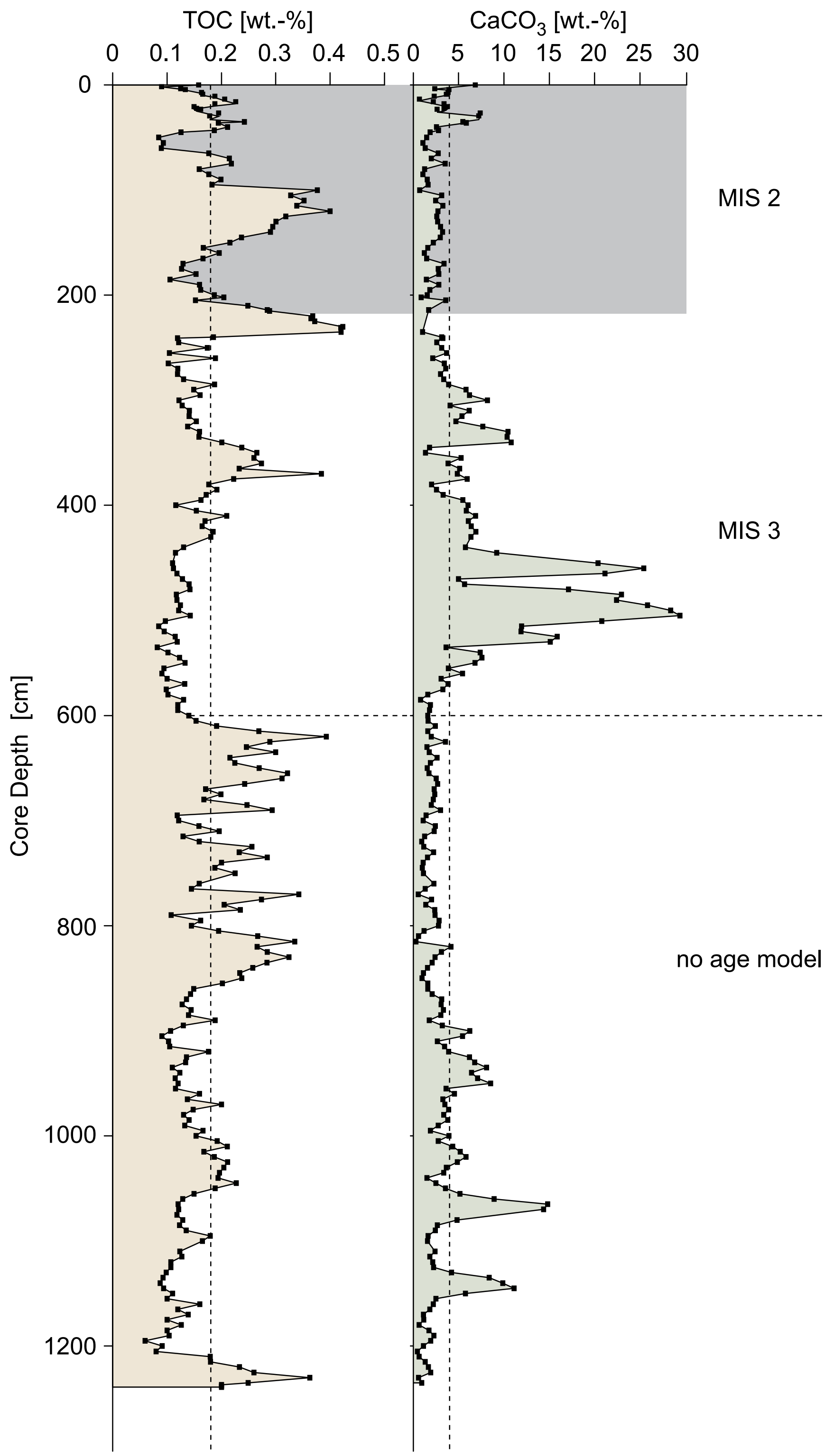


Figure 6.32 Plot of TOC and carbonate content (both in wt.-%) of core PS62/003 versus core depth (cm).

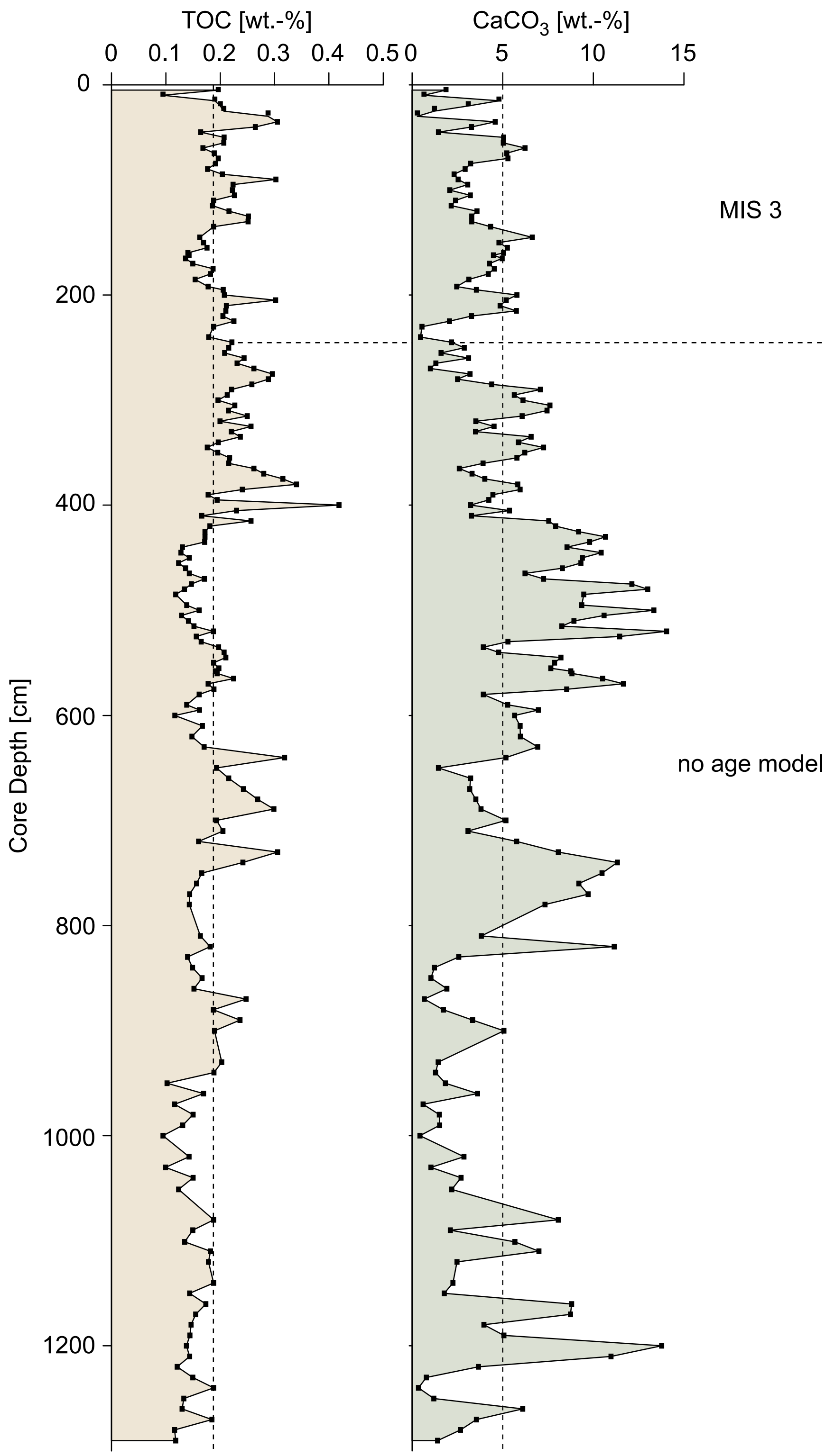


Figure 6.33 Plot of TOC and carbonate content (both in wt.-%) of core PS62/004 versus core depth (cm).

6.5.3 PS62/015 (Figure 6.34)

In general the TOC content of core PS62/015 range between 0.2 and 0.6 wt.-%, having a mean value of 0.30 wt.-%. The TOC record can be split in two parts. The upper section (0-280 cm) shows a high variability with several maxima, whereas the lower section (280-630 cm) is characterised by a more uniform distribution of values about the mean value. Only one section in the lower part (500-510 cm) has TOC values higher than 0.4 wt.-%. The core has the lowest carbonate contents (0-4 wt.-%, mean 1 wt.-%) of all investigated cores. Three different sections (0-200 cm, 200-490 cm, 490-630 cm) are distinguished. The uppermost and the lowest sections (0-200 cm, 490-630 cm) are characterised by nearly no variations and very low values (<1 wt.-%). The middle section (200-490 cm) shows in contrast some variations with very low amplitudes.

6.5.4 PS62/017 (Figure 6.35)

The mean TOC content of core PS62/017 is 0.29 wt.-%. Overall the values range between 0.1 and 0.6 wt.-%. The uppermost core section (0-90 cm) decrease trend in TOC content from the core top to 90 cm. Below follows a section with minimum TOC contents (90-140 cm). The rest of the core shows a uniform distribution with nearly constant TOC values about the mean with exception of the sections 315-320 cm and 505-515 cm, which are characterised by TOC minima and maxima, respectively. The carbonate record shows a higher variability and varies between 0 and 7 wt.-% about the mean of 2 wt.-%. The section with extreme low TOC contents (90-140 cm) shows highest carbonate values. For the rest of the core no correlation between low TOC values and high carbonate values can be observed.

6.5.5 PS2644 (Figure 6.36)

Core PS2644 has the highest sampling resolution of all investigated cores. The TOC record shows a very complex pattern with a low amplitude cyclicity about the mean of 0.23 wt.-%, especially in the section between 150 and 725 cm. Two prominent maxima with up to 0.6 wt.-% occur in the TOC record (90-150 cm, 725-750 cm). The carbonate values show a similar distribution and range about the mean of 2 wt.-%. The record is as well characterised by the same cyclic variability, especially in the section between 190 and 735 cm, and two maxima with values up to 8 wt.-%. In contrast to the TOC record, the maxima in carbonate content appear in larger and slightly depth-shifted sections (55-190 cm, 735-800 cm).

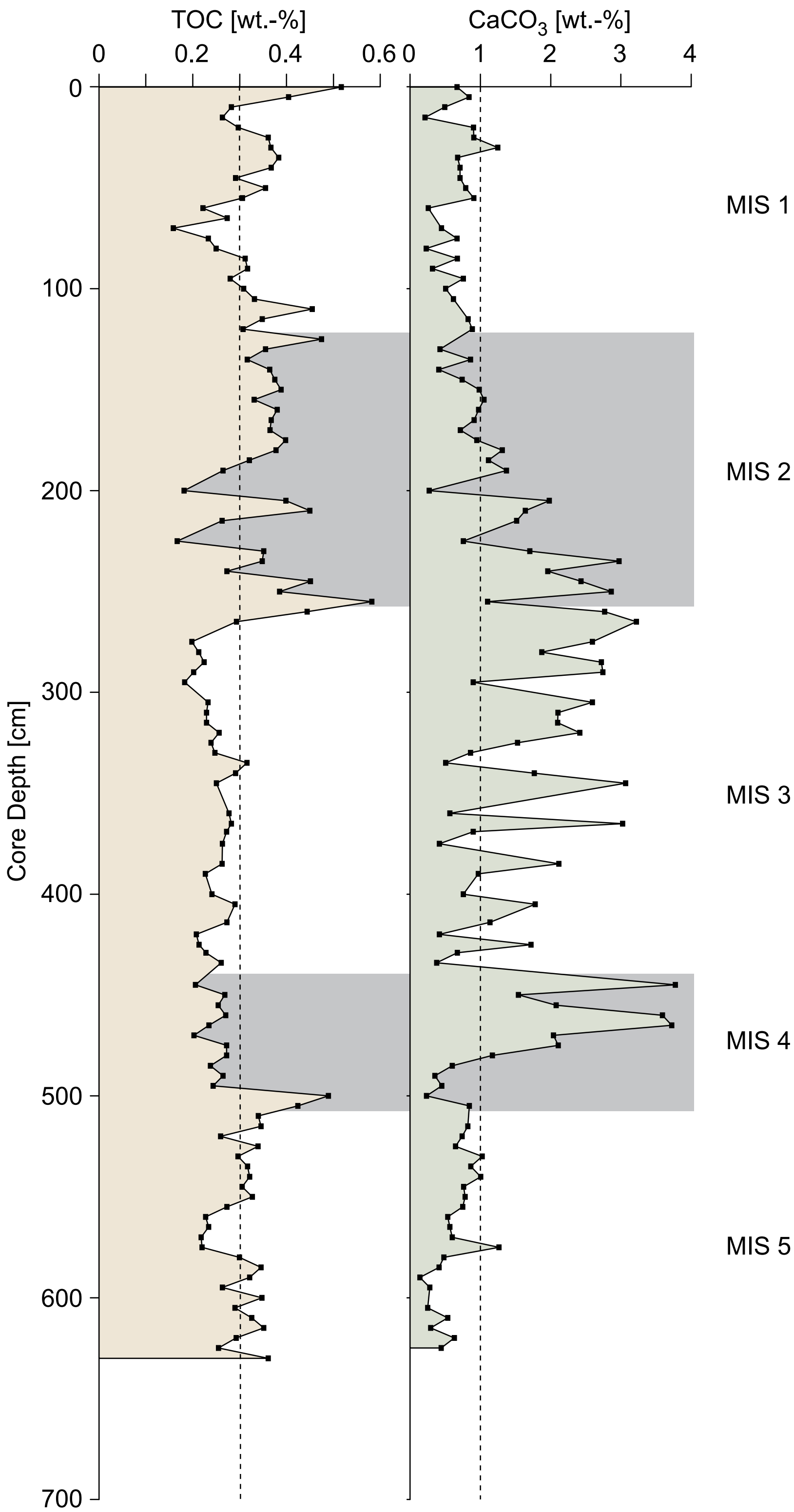


Figure 6.34 Plot of TOC and carbonate content (both in wt.-%) of core PS62/015 versus core depth (cm).

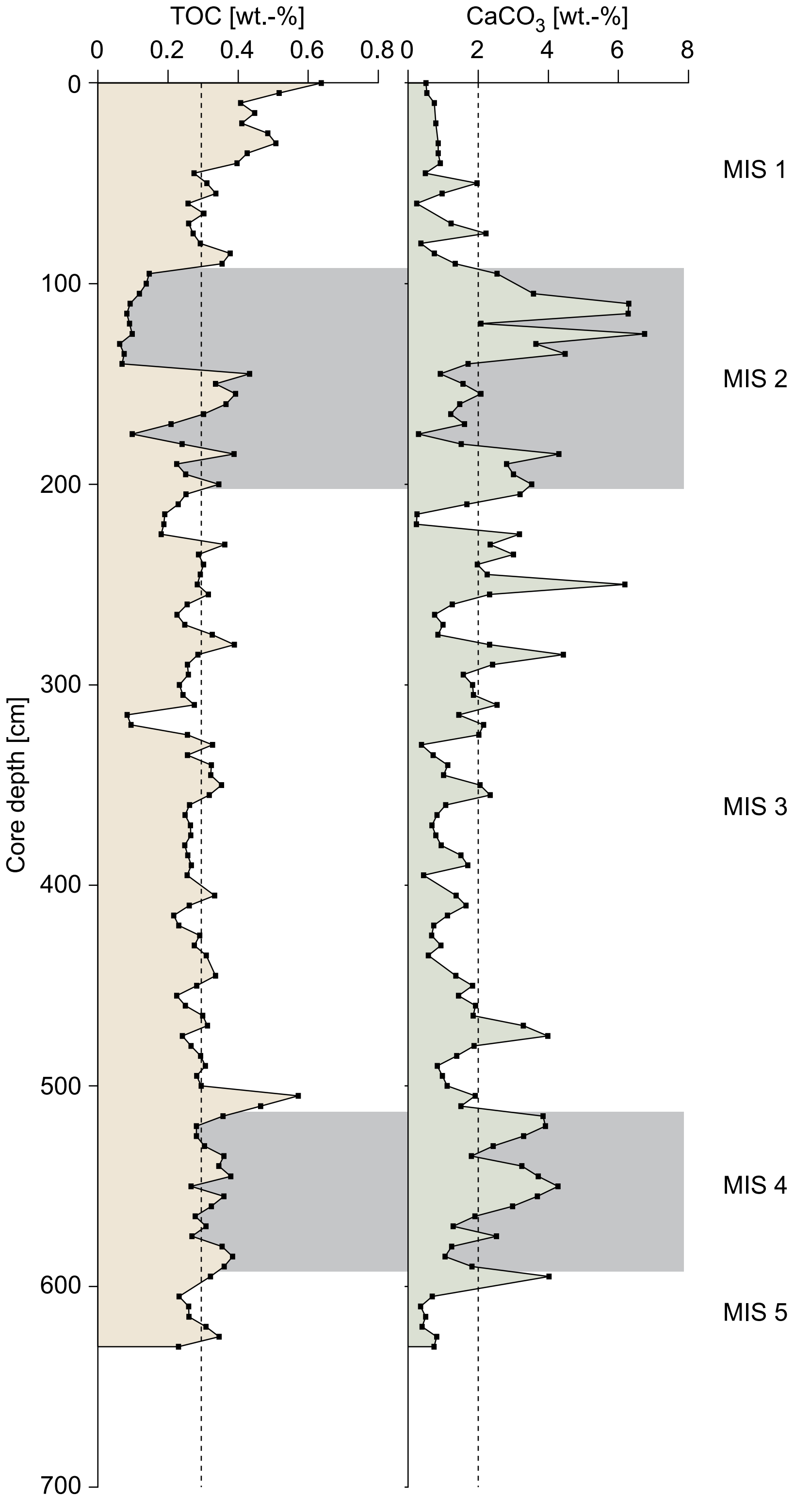


Figure 6.35 Plot of TOC and carbonate content (both in wt.-%) of core PS62/017 versus core depth (cm).

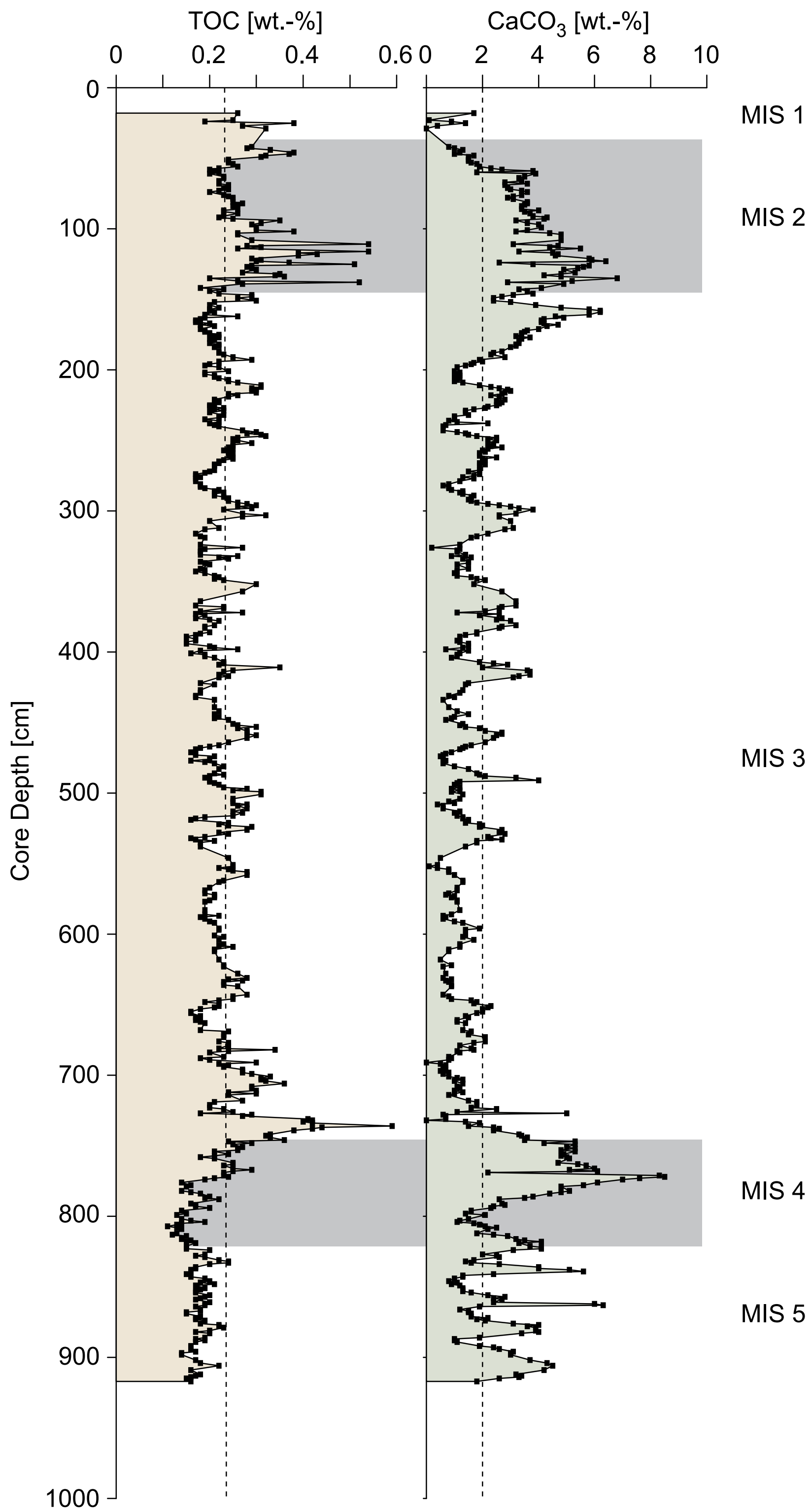


Figure 6.36 Plot of TOC and carbonate content (both in wt.-%) of core PS2644 versus core depth (cm) (unpublished data R. Stein).

7 Discussion

The following discussion is split into three sections. In the first section general aspects of the distribution of TOC and carbonate in surface sediments of the Nordic Seas are discussed and a model for the interpretation of the distribution of TOC in modern sediments of the Nordic Seas is proposed. The discussion is based on distribution maps of TOC and carbonate. The databases for the maps are previous published data and own measurements of samples from the East Greenland continental margin. The new data set allows to present a detailed map of the distribution of TOC and carbonate in the region of the East Greenland marginal ice zone between 76 and 75°N for the first time. Previous to this study, the knowledge of the distribution of TOC and carbonate in this region was restricted to single point measurements. The East Greenland marginal ice zone between 76 and 75°N is of special interest because in this region various antithetic processes control the preservation of organic matter in surface sediments. The controlling processes are discussed based on the results of organic-geochemical bulk parameter measurements and biomarker analyses in the second section of this chapter. With the use of the TOC content in sediment cores, the changes in the deposition of organic matter through the Late Quaternary is traced and a rough model for the enhanced TOC preservation and its controlling processes is proposed.

7.1 Biogenous Material of the Nordic Seas: General Aspects

The distribution of organic matter in marine surface sediments within the Nordic Seas is influenced by autochthonous marine production and input of allochthonous terrestrial organic matter. The sedimentation of the autochthonous marine production is regulated by oceanographic processes, ice cover, primary and secondary production, export fluxes and remineralisation rates whereas important factors controlling the input of allochthonous terrestrial organic matter into surface sediments of the Nordic Seas are mainly different transport and sedimentation processes.

Based on the origin of water masses and the distribution of sea ice, three distinct oceanographic domains (Polar, Arctic and Atlantic domain) are distinguished (Swift, 1986). The Arctic and the Atlantic domain have approximately the same extensions as the Polar and Atlantic province, as defined based on biological grounds by Peinert et al. (2001a) (Figure 7.1). These biological provinces differ profoundly with regard to their spatial and temporal developments in surface water physics and their production and export regimes (Peinert et al., 2001a; Sauter et al., 2001). Remote sensing data (Antoine et al., 1996) and discrete measurements (von Bodungen et al., 1995; Richardson et al., 2005) show that the annual primary production in the Polar Province (i.e., Greenland Sea) is generally lower than in the Atlantic Province (i.e., Norwegian and Iceland Sea). The annual primary production in the Greenland Sea reaches average values between 81 and 85 g C/m^2 (von Bodungen et al., 1995; Richardson et al., 2005), and the seasonal production cycle is mainly controlled by sea ice (Carroll and Carroll, 2003). In the marginal ice zone an enhanced local primary production is fostered by the highly variable physical and biological conditions (Peinert et al., 2001b; Ramseier et al., 2001). In the Atlantic Province the average annual primary production is higher and varies between 80 to 150 g C/m^2 in the Norwegian Sea and between 100 to 200 g C/m^2 in the Iceland Sea (von Bodungen et al., 1995; Sakshaug, 2004 and references therein) (Figure 7.1).

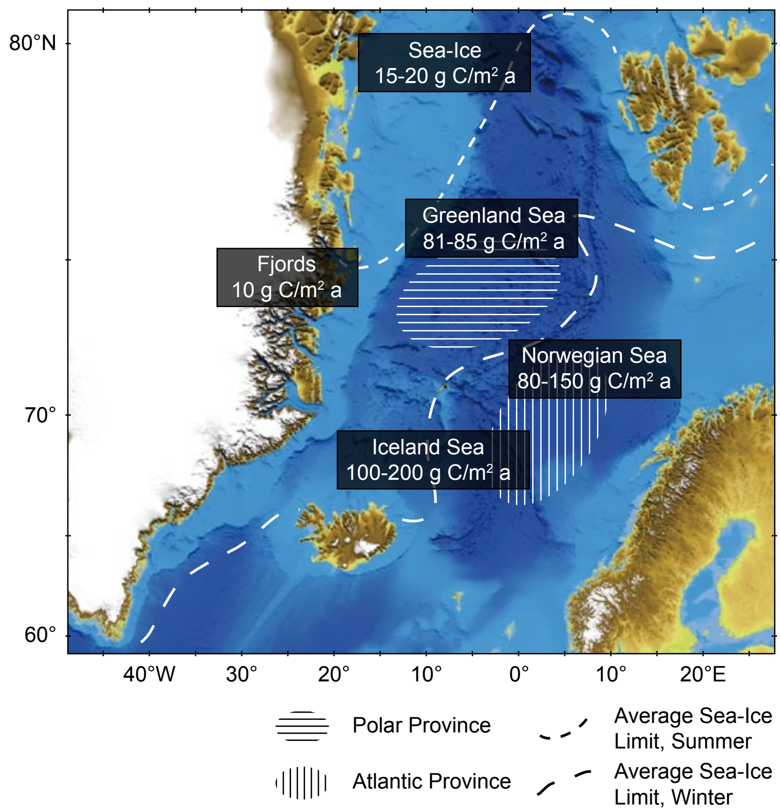


Figure 7.1 Primary production in the Nordic Seas and positions of the Polar and Atlantic province (modified after von Bodungen et al., 1995; Gosselin et al., 1997; Pomeroy, 1997; Rysgaard et al., 1999; Peinert et al., 2001a; Richardson et al., 2005).

Less than 5 to 10% of the primary produced organic material is exported from the euphotic zone and passively sinks down to the seafloor (Bruland et al., 1989; Wakeham and Lee, 1993). Generally, the export fluxes of organic carbon and carbonate determined in the Atlantic province are higher than those determined in the Polar province in comparable water depth (von Bodungen et al., 1995; Peinert et al., 2001a; Sauter et al., 2001; Bauerfeind et al., 2005). While ice-related physical and biological seasonality as well as pelagic settings jointly control fluxes in the Polar province, feeding strategies, life histories and the succession of dominant mesozooplankters are most significant in controlling fluxes in the Atlantic province (Peinert et al., 2001a). Also the composition of the exported particles varies between the provinces. In the Atlantic province more calcareous particles are exported whereas in the Polar province the export of siliceous particles dominates (von Bodungen et al., 1995; Peinert et al., 2001a; Sauter et al., 2001; Bauerfeind et al., 2005).

7.1.1 Total Organic Carbon Distribution and its Controlling Factors

The general differences in primary production are not reflected in the distribution of TOC in modern surface sediments of the Nordic Seas (Figure 7.2). The TOC contents range from 0.1 to 2.6 wt.-% and are distinctly higher than the average TOC content of deep-sea sediments, which is about 0.25 wt.-% (Pedersen and Calvert, 1990). In the Fram Strait the TOC contents show a distinct east-west gradient, whereas in the central and southern part of the Nordic Seas no trend in the distribution of TOC is obvious. The TOC contents of the Polar and Atlantic province are of comparable magnitude. Locally high TOC contents (1.0-1.5 wt.-%) are observed in front of single East Greenlandic fjord systems. Highest TOC contents occur in sediments around Svalbard. In the eastern Fram Strait, the Barents Sea, and on the Yermak Plateau TOC values range from 1.0 to 2.6 wt.-%. The distribution of TOC in modern sediments of the Nordic Seas are not only controlled by primary production and export fluxes. It is obvious that areas with a comparable primary production and export rates differ significant in their TOC contents (Schäfer-Pinto, 1999). Consequently, it is necessary to take other processes like the degradation of organic carbon and the input and relocation of allochthonous material into account.

During sinking from the euphotic zone to the sea floor the organic material degrades, resulting in a generally decrease of fluxes towards greater water depth (Bruland et al., 1989). The half-depth of POC, defined as the depth range over which 50% of the material has been lost by

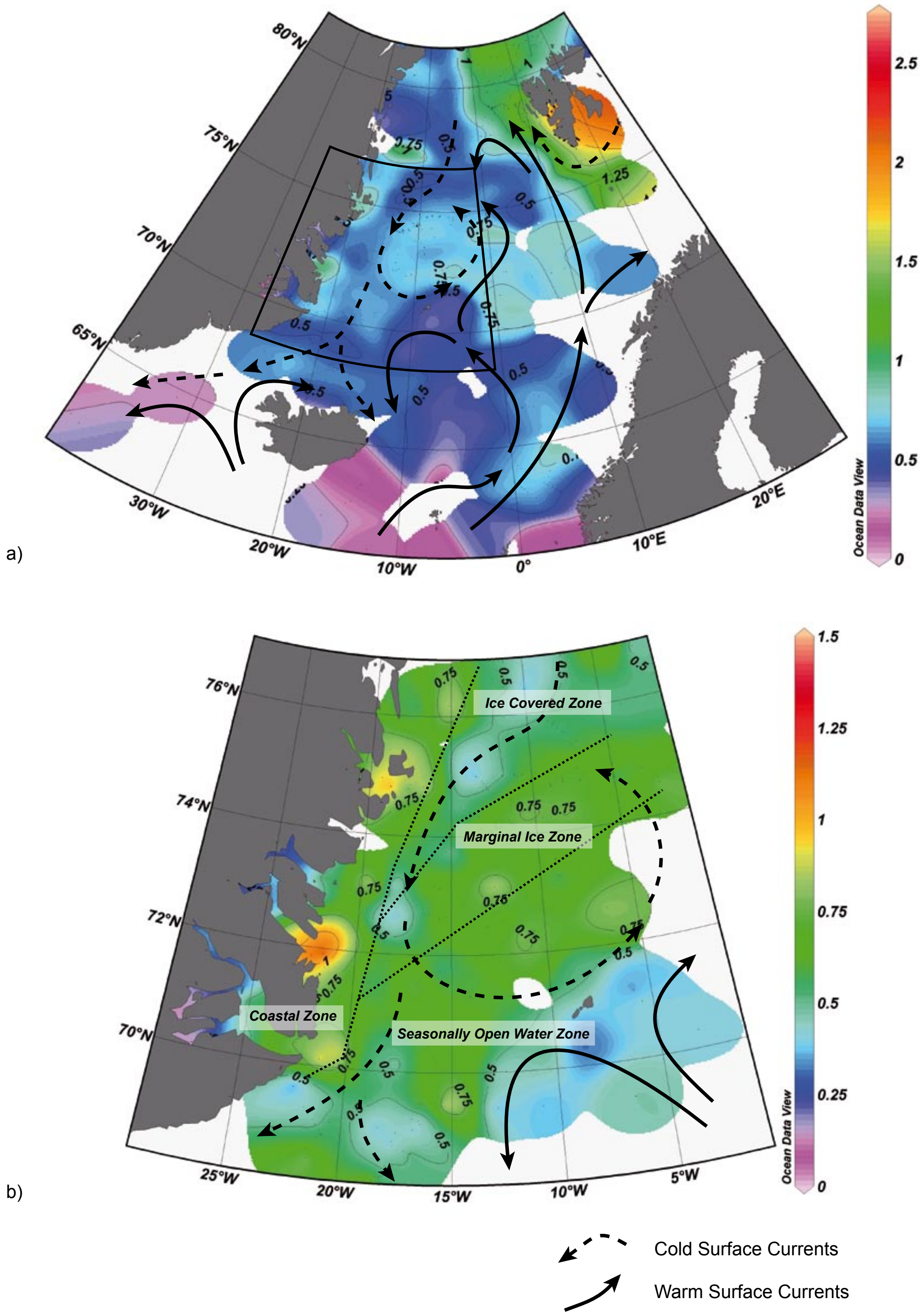


Figure 7.2 Distribution of TOC (in wt.-%) in surface sediments of **a)** the Nordic Seas and **b)** the East Greenland continental margin. For sample location and references see Chapter 6.2.1.

degradation, is in an open-ocean environment about 2000 m (Wakeham and Lee, 1993). A longer residence time of organic material in the water column also supports an enhanced degradation. As a consequence only 1.7% of the primary production reaches the deep basins of the Greenland and Norwegian Sea whereas 3.3% of the primary production is transferred to the shallower Iceland Plateau (Schäfer-Pinto, 1999; Schlüter et al., 2000). After the biogenic particles have reached the sea floor, more than 95% of the remaining organic carbon is remineralised at the sediment-water interface in the uppermost millimetres of the sediment (Schäfer-Pinto, 1999; Schlüter et al., 2000; Sauter et al., 2001). High sedimentation rates reduce the residence time of organic carbon at the sediment-water interface and therefore contribute to a lower degradation and a better preservation of the organic carbon (Müller and Suess, 1979). The degradation rates of TOC at the sediment-water interface show a distinct relation to water depth and decrease with increasing water depth (Mayer, 1993; Sauter et al., 2001). In general, the TOC degradation rates are higher in the Atlantic than in the Polar province in comparable water depth (Sauter et al., 2001).

Additionally to the sedimentation of the autochthonous marine production, the input and relocation of allochthonous terrigenous material controls the distribution of TOC in the Nordic Seas. In the Polar province large amounts of organic-rich terrigenous material with TOC contents up to 6.4 wt.-%, are transported by sea ice, icebergs, and ocean currents from the Arctic Ocean into the Nordic Seas (Wollenburg, 1993; Nürnberg et al., 1994; Stein et al., 1994; Fohrmann et al., 2001; Eicken, 2004; Stein and Macdonald, 2004b; this study). Melting of sea ice in the corridor of the EGC leads to the release of the incorporated material (Ramseier et al., 2001). The lateral supply of fine-grained terrigenous lithogenic and organic material enhances the formation of large, rapidly sinking particles like faecal pellets and marine snow (Alldredge, 2001; Lampitt, 2001).

Modern ocean current-controlled particle transport in the Nordic Seas is strongly coupled to the large-scale circulation regime, which results in sediment transfer across the large ocean gateways in the north and south (Fohrmann et al., 2001). According to Stein and Macdonald (2004b) about 52 Mt sediment are annually imported from the Arctic Ocean into the Nordic Seas via ocean currents. This amount is six times higher than the amount of ice-transported sediments (8.6 Mt/a) and therefore the most important factor to be considered for the input of allochthonous terrigenous organic matter (TOM).

Gravity-driven mass movements at continental margins of both provinces are responsible for the relocation of sediments from the shelves into the deep sea (Vorren et al., 1998; Fohrmann et al., 2001; Rumohr et al., 2001). In general, East Greenland fjord systems act as sediment sinks (Dowdeswell et al., 1994) but locally higher TOC contents in front of single fjord systems suggest a transport of TOM onto the inner shelf. In contrast, sedimentation around Svalbard is characterised by river/meltwater discharge and coastal erosion resulting in a high supply of TOM (Winkelmann and Knies, 2005). Another important factor controlling the distribution of TOC is winnowing. Strong bottom currents as the Denmark Strait and Iceland-Færœ-Ridge Overflow Currents and the East Greenland Current wash out the fine grain sizes, resulting in an enhanced percentage of coarse terrigenous components. This process decreases the organic carbon content because the organic matter is adsorbed onto mineral surfaces and has a high affinity for fine-grained sediments (Hedges and Keil, 1995).

Considering all these factors, the following model for the interpretation of the distribution of TOC in modern sediments of the Nordic Seas is proposed:
The Norwegian Sea and eastern Iceland Sea are characterised by an enhanced primary production and therewith coupled enhanced TOC fluxes. The degradation rate at the sediment-water interface is relatively low and leads to TOC contents between 0.4 and 1.0 wt.-%. The organic matter is assumed to be predominantely of marine origin. High TOC contents in the Fram Strait and around Svalbard (>1.0 wt.-%) are ascribed to the locally enhanced primary production and flux rates related to the marginal ice zone, the shallower water depth, and the supply of TOM by river/meltwater discharge, coastal erosion, and melting sea ice of the ESC and the related formation of larger particles ("ballast effect") which fosters a better preservation of MOM. The TOC contents between 0.4 and 0.8 wt.-% in the corridor of the EGC are the result of complex interactions between various factors. On the one hand, reduced primary production and flux rates due to sea ice, dilution of the sediment by terrigenous particles, higher degradation rates of TOC at the sediment-water interface, and winnowing of the fine sediments are responsible for reduced TOC contents. On the other hand, input of TOM by melting sea ice of the EGC and the related formation of larger particles ("ballast effect"), and the locally enhanced primary production and flux rates related to the marginal ice zone lead to enhanced TOC contents. As a consequence the TOC contents in the whole Polar province are nearly constant and comparable to TOC contents in the southern Atlantic province. The local transport of organic matter out of single

East Greenland fjord systems is responsible for the enhanced TOC contents on the inner shelf in front of the Skærfjorden, Hochstetterbugten, and Kong Oscar Fjord. The very low TOC contents on the Greenland-Scotland Ridge are likely the result of winnowing by strong bottom currents overflowing the ridge.

7.1.2 Distribution of Calcium Carbonate and its Controlling Factors

The distribution map of carbonate in marine surface sediments of the Nordic Seas corresponds fairly well with previously published maps by Hebbeln et al. (1998), Huber et al. (2000) and Taylor et al. (2002) (Figure 7.3). Regional differences between the maps are due to the higher spatial resolution of this study, especially in the western Nordic Seas and around Svalbard, and the interpretation by a gridding algorithm instead of visual interpolation of isolines. The recent carbonate sedimentation in the Nordic Seas is closely related to the surface current systems, and in all studies the carbonate content is interpreted to reflect in first-order the biological production (Hebbeln et al., 1998; Matthiessen et al., 2001), because the input of detritic carbonate is negligible (Huber et al., 2000; Bauerfeind et al., 2005).

Carbonate contents reach highest values (25-50 wt.-%) in the Atlantic province. Towards the East Greenland continental margin, a general decrease of carbonate contents is observed. Sediments of the Polar province are characterised by lower carbonate contents (<20 wt.-%). Even small-scale surface currents are reflected by the distribution of carbonate in modern sediments. The sediments underlying the cold JMC and EIC have reduced carbonate contents (0-20 wt.-%) whereas the sediments underlying the warm RAC and the recirculating Atlantic waters south of Jan Mayen are characterised by higher carbonate contents ranging from 20 to 30 wt.-%. Lowest carbonate contents (<10 wt.-%) occur on the Greenland-Scotland Ridge, in the Fram Strait and on the East Greenland continental margin.

Physical and biological processes control the variations in the distribution of biogenic carbonate in the Nordic Seas. Important processes are dilution by terrigenous material, dissolution, winnowing of fine sediments by currents, and different carbonate production and flux rates in the Polar and Atlantic provinces (Baumann et al., 1993; Hebbeln et al., 1998; Huber et al., 2000; Matthiessen et al., 2001; Peinert et al., 2001a). The input of high amounts of terrigenous material leads to a dilution of the pelagic carbonate signal. Downslope transport of terrigenous material accounts for the relative low carbonate contents

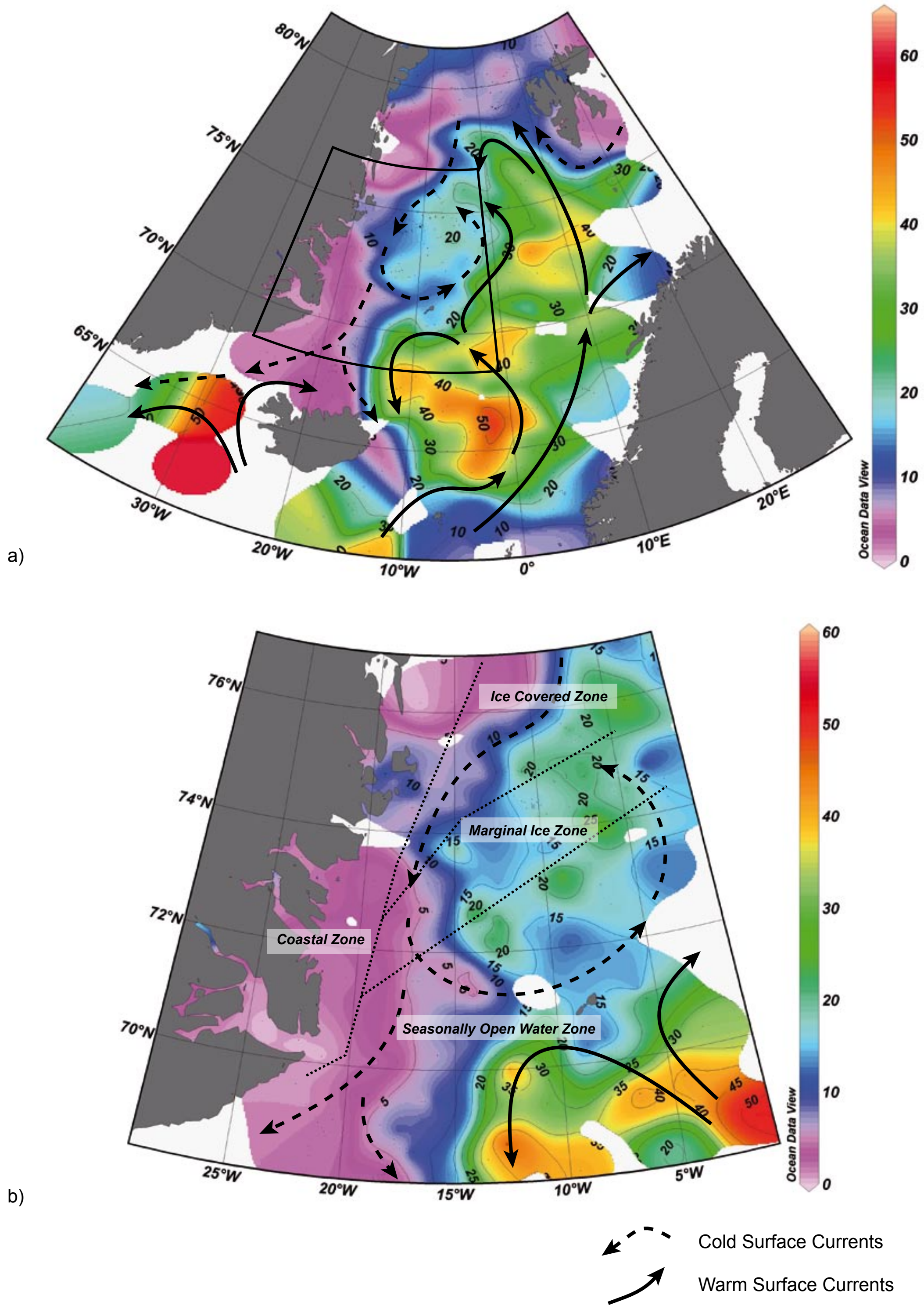


Figure 7.3 Distribution of carbonate (in wt.-%) in surface sediments of **a)** the Nordic Seas and **b)** the East Greenland continental margin. For sample location and references see Chapter 6.2.1.

along the continental slopes (e.g., off central Norway and Svalbard) and sediments released by melting sea ice dilute the carbonate signal in the western Nordic Seas (Baumann et al., 1993; Hebbeln et al., 1998). In addition to dilution, dissolution effects the distribution of carbonate in the Nordic Seas. Well-preserved carbonate tests occur along the inflow of relatively warm Atlantic surface water whereas high carbonate dissolution is observed along the continental margins off Greenland and Norway and in the deepest parts of the Greenland Basin (Huber et al., 2000). Based on their investigations they conclude that supralysoclinal processes, influencing the pore water chemistry of surface sediments, are most important for carbonate preservation in the Nordic Seas. These processes are controlled by the flux rates of carbonate and TOC. While high carbonate fluxes foster an enhanced preservation, high TOC flux rates cause an increased dissolution of carbonate in sediments (Huber et al., 2000). In the Fram Strait, on the Greenland-Scotland Ridge, and in coastal areas strong overflow currents and tidal currents, respectively, wash out fine grain sizes (Berner and Wefer, 1990; Baumann et al., 1993) resulting in an enrichment of coarse terrigenous components in the sediments. As both, coccolithophorides and planktic foraminifera, the main producers of biogenic carbonate in the Nordic Seas (Matthiessen et al., 2001), are subjected to sediment transport as fine grain sizes (Michels, 2000), winnowing leads to the depletion of carbonate in sediments of this regions.

Most calcareous organisms (e.g., planktic foraminifera, coccolithophorides) are adapted to the warm Atlantic waters. Only few calcareous species are adapted to the cold Polar water masses (Matthiessen et al., 2001; Schröder-Ritzrau et al., 2001). In the Polar province siliceous and organic-walled organisms (e.g., radiolarians, diatoms, dinoflagellates) are the most abundant species (Matthiessen et al., 2001; Schröder-Ritzrau et al., 2001). As a result, carbonate production in the Norwegian Sea is significantly higher than in the Greenland Sea. The higher carbonate production causes also a higher carbonate sedimentation in the Atlantic than in the Polar province where the sedimentation of opal is of greater importance (Bauerfeind et al., 1994; von Bodungen et al., 1995; Peinert et al., 2001a; Schlüter et al., 2001; Bauerfeind et al., 2005). Furthermore, a lateral deep transport of particles including carbonate from the Polar province into the Atlantic province contribute to higher carbonate flux rates in the Atlantic province (von Bodungen et al., 1995; Kohly, 1998; Peinert et al., 2001a).

7.2 Sedimentation of Organic Carbon at the East Greenland Continental Margin

Due to a limited database the processes, controlling the distribution of organic matter on a polar continental margin like the East Greenland continental margin are poorly understood and partly based on speculations. This gap in knowledge has been filled by this study. The new data from marine surface sediments from the East Greenland continental margin and sediments of possible source areas for the supply of terrigenous organic matter (i.e., sea-ice/iceberg sediments and sediments from onshore East Greenland) allow to propose a model for the input and burial of organic matter. In addition to the measurements of organic-geochemical bulk parameters, biomarker analyses were performed to understand the complex interactions between various factors controlling the input and preservation of organic matter. The results of the biomarker analyses are used to distinguish between MOM and TOM and to estimate the relevance of the different sources for the input of organic matter into marine surface sediments at the East Greenland continental margin. In the discussion mainly absolute concentrations (in µg/g Sed.) are used. However, when interpreting the absolute concentrations it has to be taken into account that the effect of dilution of organic material by lithogenic particles causes lower absolute concentrations in areas with higher sedimentation rates and vice versa. As described in Chapter 6.1 the samples are grouped in zones based on the differences in their geographical, hydrological and environmental settings. In the following discussion the environmental settings of the *Coastal Zone*, *Ice Covered Zone*, *Marginal Ice Zone*, and *Seasonally Open Water Zone* are presented first.

7.2.1 Environmental Settings of the Marine Zones

The *Coastal Zone* includes samples originating from the East Greenland fjord systems and the inner shelf from water depth between 109 and 942 m (Figure 6.1; Appendix A). The region is characterised by a strong sediment supply from Greenland and a seasonal sea-ice cover. High volumes of sediment-laden meltwater is discharged seasonally into the East Greenland fjord systems, causing high sedimentation rates in the fjords. According to Evans et al. (2002) sedimention rates in the Kejser Franz Joseph Fjord reach up to 90 cm/ka and in fjords further to the south even higher sedimentation rates (>220 cm/ka) are estimated (Smith et al., 2002 and references therein). Significant amounts of sediment-laden meltwaters escape from the fjords during spring/summer and transport large volumes onto the inner shelf leading to high sediment fluxes (90-117 g/cm^2 ka) in the inner shelf bathymetric deeps (Dowdeswell et al., 1994; Evans et al., 2002; Smith et al., 2002). The ice inventory of the *Coastal Zone* mainly consists of icebergs derived form fast-flowing outlet glaciers of the Greenland Ice Sheet and first-year ice (Wadhams, 1986; Reeh, 2004). Multi-year ice is of minor importance. In certain well-defined areas coastal polynyas and land water, a narrow strip of open water along the coastline, are seasonally formed (Wadhams, 1986). The biological production is limited to the ice-free period and the main contributors to primary production are phytoplankton, macroalgae and benthic diatoms (Glud et al., 2002). However, over 85% of the annual pelagic primary production is grazed by zooplankton, consisting mainly of copepods, and only a minor fraction reaches the sediment (Glud et al., 2000, 2002).

Samples grouped in the *Ice Covered Zone* originate from the outer shelf, continental slope and deep sea from water depth between 253 and 3134 m, i.e., an area covered by sea ice nearly the entire year (Figure 6.1; Appendix A). The sea ice consists on an average of 85% of multi-year ice, which is formed on the Siberian shelves and transported via the Transpolar Drift through the Fram Strait into the Nordic Seas (Vinje and Finnekåsa, 1986; Pfirman et al., 1997; Eicken, 2004). Icebergs are rare, originating from outlet glaciers in northernmost Greenland (Rignot et al., 1997; Reeh, 2004). On a small scale seasonnal melting occur, resulting in the release of the incorporated sediments (Pfirman et al., 1990; Ramseier et al., 2001; Bauerfeind et al., 2005). Sediment transport from the inner shelf towards the deep sea does not occur (Dowdeswell et al., 1994; Evans et al., 2002; Soltwedel et al., 2005). Accordingly, sedimentation on the outer shelf, the continental slope and in the deep sea is restricted to hemipelagic sedimentation with low sedimentation rates (<4 cm/ka) and sporadic sedimentation of IRD (Paetsch et al., 1992; Nam, 1997; Evans et al., 2002). Under- and in-ice diatoms and amphipods are main contributors to the very restricted biological production in the permanently ice-covered region (Gradinger et al., 1999; Mock and Thomas, 2005).

The marginal ice zone is defined as the transition zone between the pack ice and the open ocean (e.g., Ramseier et al., 1999; Peinert et al., 2001b). Samples arranged in *Marginal Ice Zone* originate from water depths between 850 and 3624 m (Figure 6.1; Appendix A). The zone is characterised by highly variable physical and biological conditions caused by sea-ice dynamics (Ramseier et al., 1999, 2001; Peinert et al., 2001b). Melting of the multi-year sea ice, originating from the Siberian shelves, results in the release of the incorporated sediments

(Pfirman et al., 1990; Ramseier et al., 2001). The sea-ice sediments consist approximately by two-thirds of terrigenous and one-third of biogenous material (Nürnberg et al., 1994). Meltwater-related processes at the ice edge foster enhanced biological production as they favour local blooms of phytoplankton, which then are grazed by zooplankton (Sullivan et al., 1988; Peinert et al., 2001b; Richardson et al., 2005). Diatoms are the most abundant species in sea ice as well as in phytoplankton communities, and zooplankton is dominated by copepods (Gradinger et al., 1999; Sakshaug, 2004). In the *Marginal Ice Zone*, lateral sediment transport processes like gravity-driven mass movements from the shelf into the deep sea are of minor importance. As in the *Ice Covered Zone*, the sedimentation rates are low (<4 cm/ka) in the *Marginal Ice Zone* (Paetsch et al., 1992; Nam, 1997; Evans et al., 2002).

Samples of the *Seasonally Open Water Zone* originate from south of 71.5°N from water depths between 910 and 3758 m. This region includes the Scoresby and Blosseville Basin, the Denmark Strait, and the Irminger Basin (Figure 6.1; Appendix A). Only in winter a sea-ice cover is developed (Martin and Wadhams, 1999; Divine and Dick, 2006). Diatoms are the dominant phytoplankton in the *Seasonally Open Water Zone* (Sanders et al., 2005). The annual primary production is low (60 g C/m^2) and restricted to summer (Sanders et al., 2005). The sedimentation rate is as low as in the *Ice Covered Zone* and the *Marginal Ice Zone*. Additionally, strong bottom currents, related to the Denmark Strait Overflow, occur and affect the sediments from the Denmark Strait and the Irminger Basin as they wash out fine grain sizes (Lemke, 2003; Lorenz, 2005; Millo, 2005).

7.2.2 Distribution of Organic Carbon and Biomarkers at the East Greenland Continental Margin

The distribution of organic matter in sediments is controlled by different factors such as supply of marine and terrigenous organic matter, flux of organic matter to the sea floor, degradation of organic matter in the water column as well as at the sediment-water interface, sedimentation rate, and grain-size distribution in sediments (e.g., Müller and Suess, 1979; Stein, 1991; Hedges and Keil, 1995; Hartnett et al., 1998) (Figure 7.4). In general, the potential for organic carbon deposition and preservation is more favourable in near-shore areas than in the open-ocean environment (Stein, 1991).

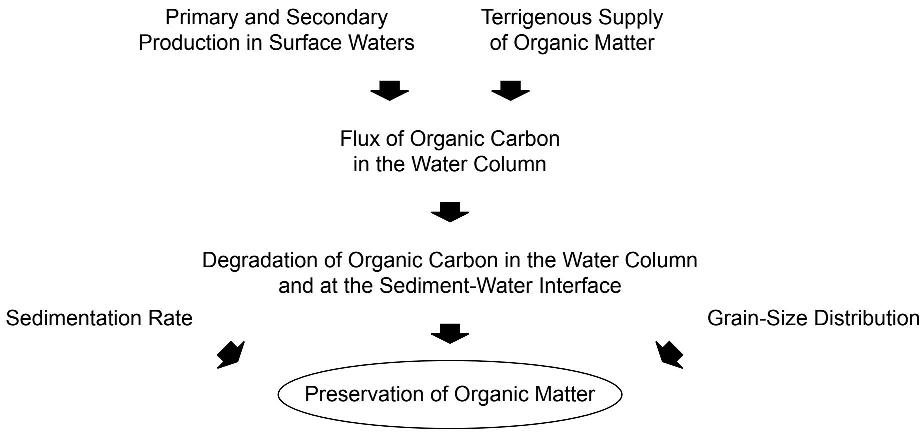


Figure 7.4 Factors controlling the distribution of organic matter in sediments.

However, the TOC contents in surface sediments of the East Greenland continental margin show a contrary and unexpected distribution pattern (Figure 7.1). The lowest TOC contents occur in the fjords whereas the inner shelf is characterised by higher values. In front of the Hochstetterbugten and the Kong Oscar Fjord the TOC contents reach maximum values. In general, TOC contents in *Coastal Zone* samples show highest variability. Sediments of the *Ice Covered Zone* have the lowest mean TOC content, showing low variability. The TOC contents increase towards the ice edge and in *Marginal Ice Zone* samples the TOC contents are alomost consistently high. With increasing distance to the ice edge the TOC contents decrease slightly in the *Seasonally Open Water Zone*. The sediments from possible source areas for the input of TOM into marine sediments of the East Greenland continental margin have variable TOC contents. In *Onshore Zone* samples very low TOC contents are measured whereas the *Sea-Ice Zone* have highest TOC contents of all measured samples.

Biomarkers display a slightly different distribution than TOC in the *Coastal Zone* but are comparable to the distribution of TOC in the other marine zones (Figure 6.19). In general, *Coastal Zone* samples show highest biomarker concentrations but also highest variability. The concentrations decrease in the *Ice Covered Zone* and they increase again in the *Marginal Ice Zone*. The samples of the *Seasonally Open Water Zone* have also higher amounts than *Ice Covered Zone* samples but lower than *Marginal Ice Zone* samples (Table 6.2). Regarding their composition and concentration of biomarkers, the samples of the different zones profoundly differ (Table 6.2). Therefore the distribution of biomarkers is exemplarily presented along 4 transects. Transect I to III and transect IV give an overview of the distribution of primary production-, secondary input-, and higher plant-derived biomarkers and biomarker ratios across and along the East Greenland continental margin, respectively (Figure 7.5-7.9). To identify the factors causing the distribution of TOC and biomarkers, in the following the controlling processes are discussed and their importance for the preservation of organic matter an the East Greenland continental margin is estimated.

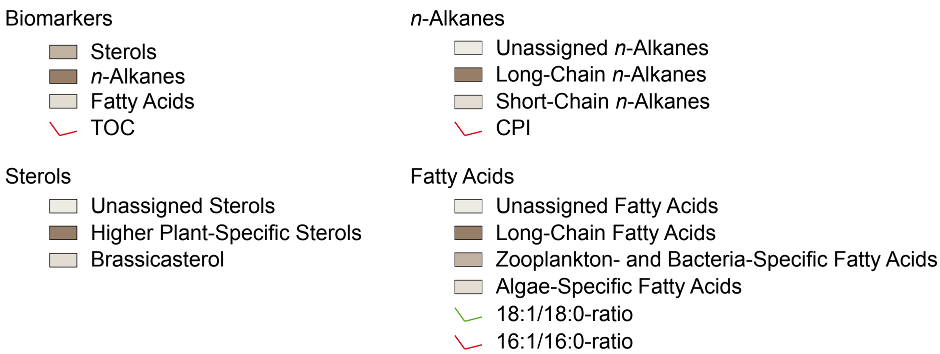


Figure 7.5 Legend for Figures 7.6 to 7.9.

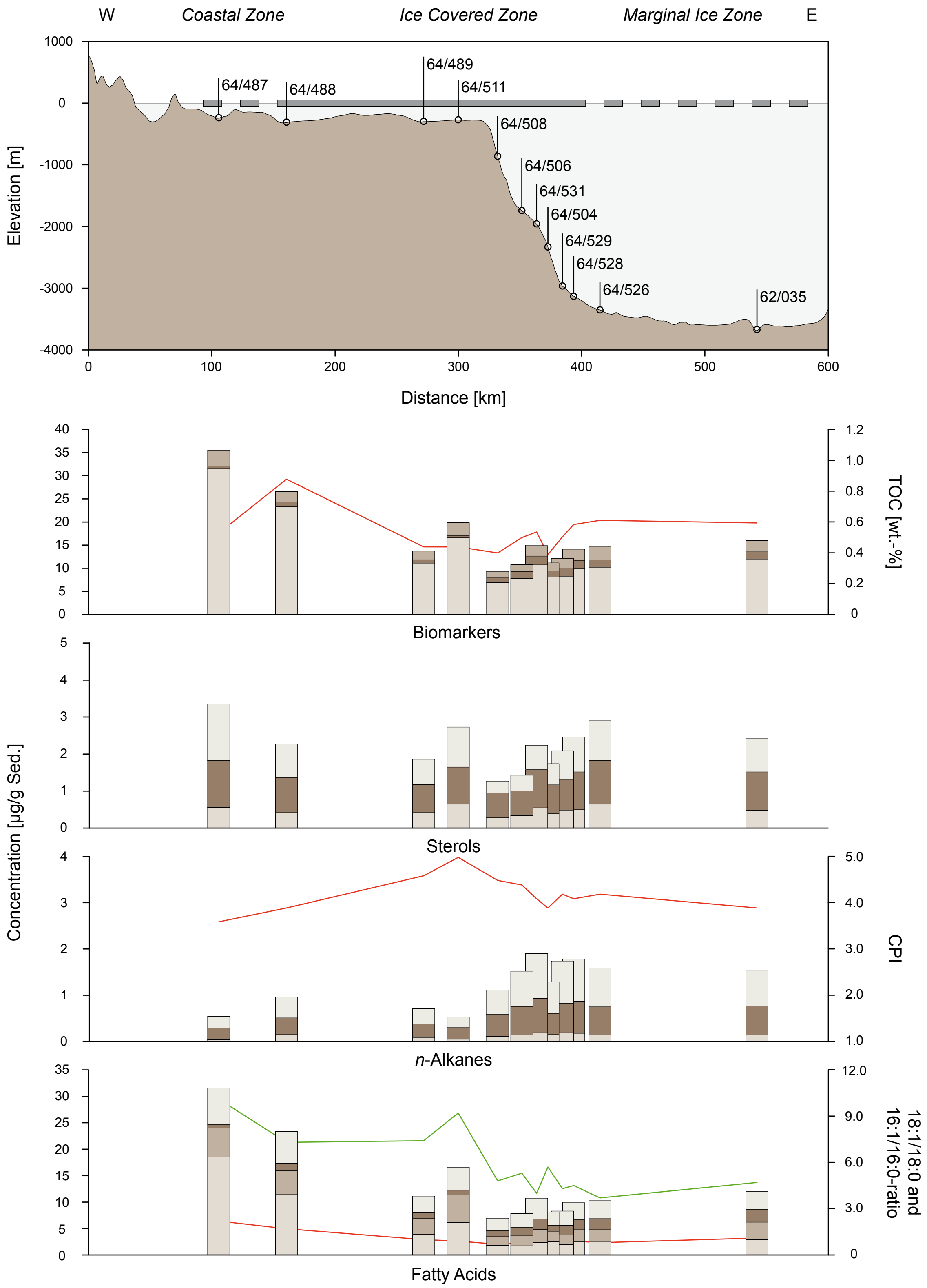


Figure 7.6 Transect I across the East Greenland continental margin with concentrations of biomarkers, sterols, *n*-alkanes and fatty acids (in µg/g Sed.). For location of transect and legend see Figure 6.1 and Figure 7.5, respectively.

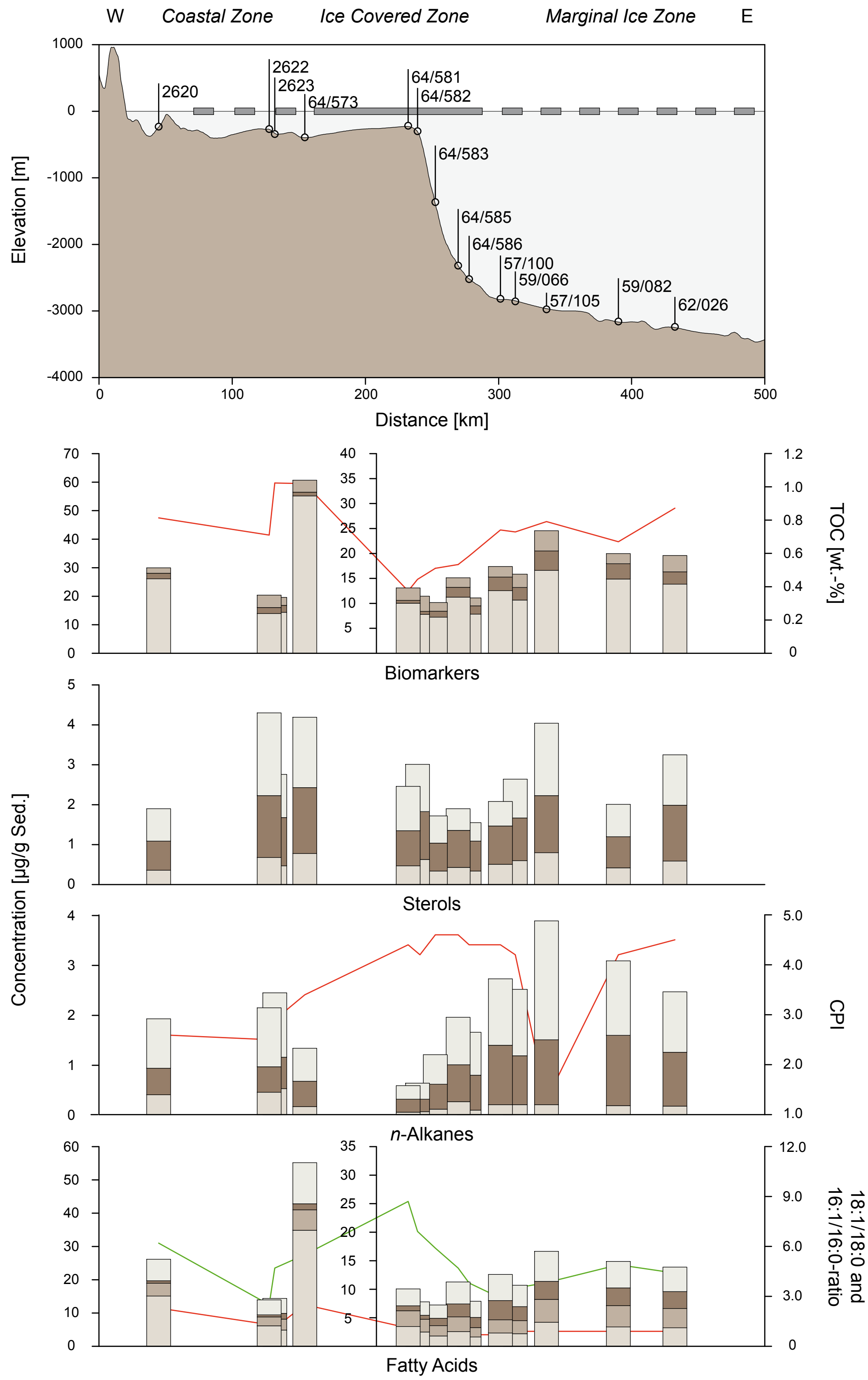


Figure 7.7 Transect II across the East Greenland continental margin with concentrations of biomarkers, sterols, *n*-alkanes and fatty acids (in µg/g Sed.). For location of transect and legend see Figure 6.1 and Figure 7.5, respectively.

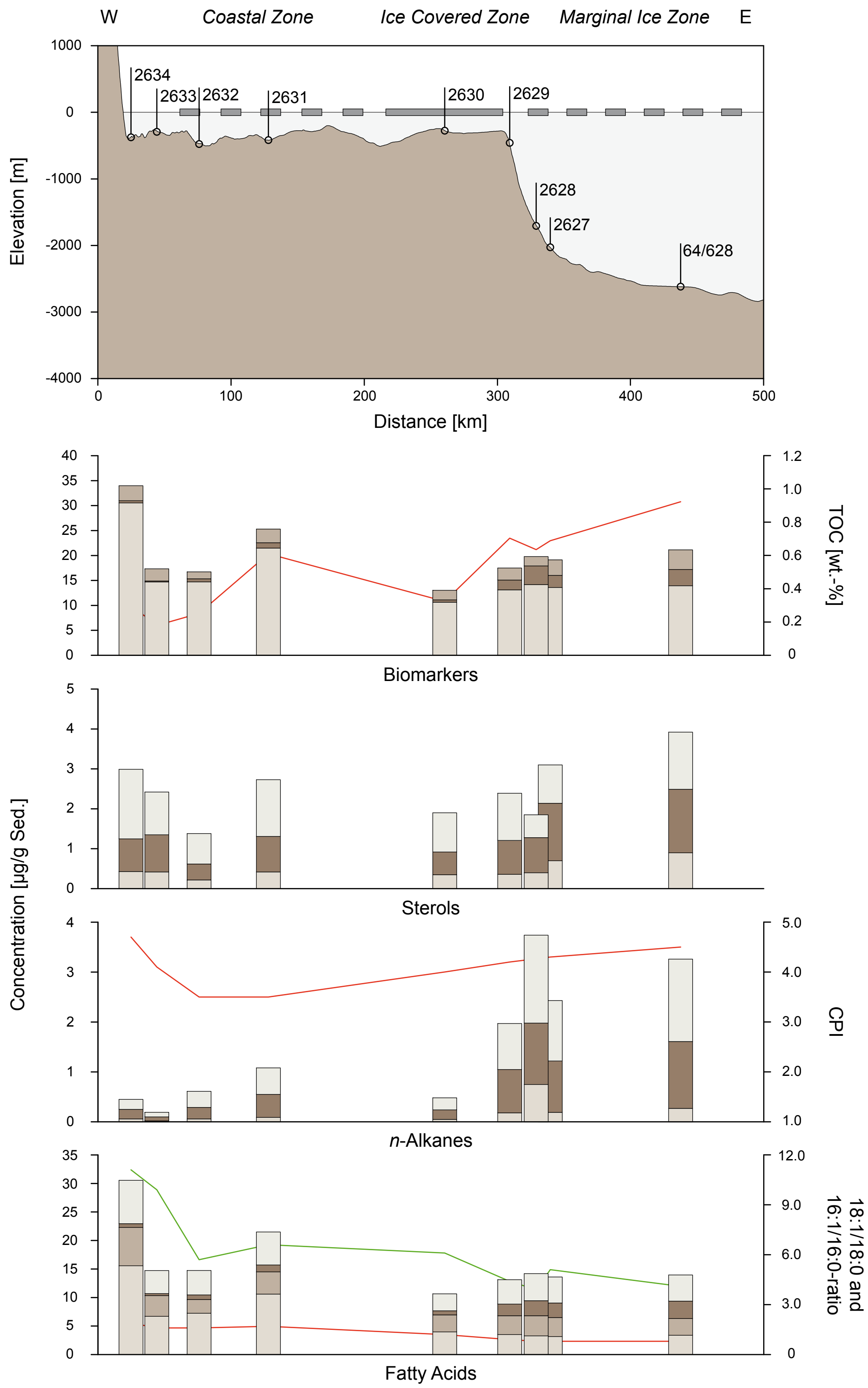


Figure 7.8 Transect III across the East Greenland continental margin with concentrations of biomarkers, sterols, *n*-alkanes and fatty acids (in µg/g Sed.). For location of transect and legend see Figure 6.1 and Figure 7.5, respectively.

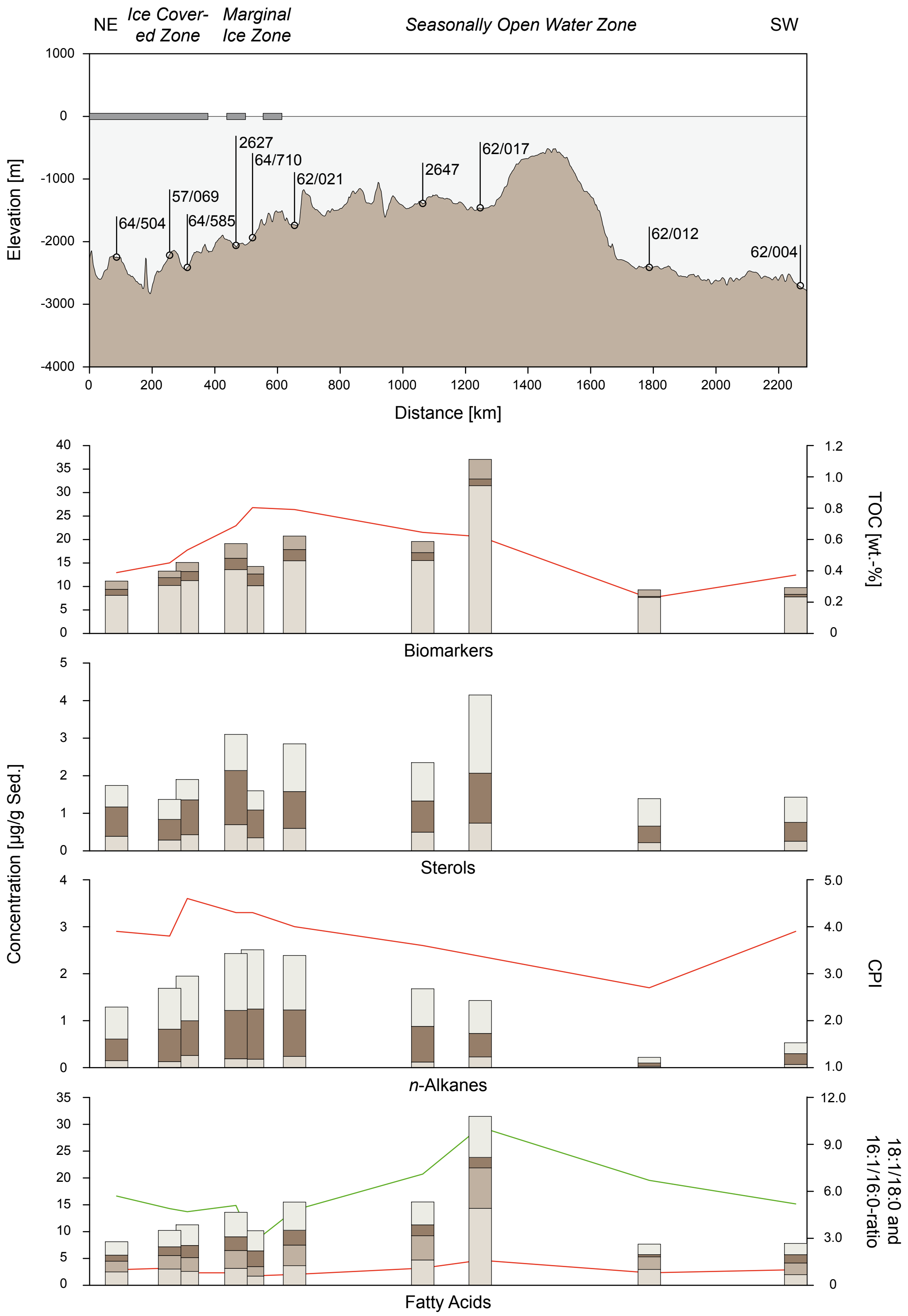


Figure 7.9 Transect IV along the East Greenland continental margin with concentrations of biomarkers, sterols, *n*-alkanes and fatty acids (in µg/g Sed.). For location of transect and legend see Figure 6.1 and Figure 7.5, respectively.

7.2.3 Primary and Secondary Production in Surface Waters

Short-chain *n*-alkanes, algae-specific fatty acids and brassicasterol are used as primary production-derived biomarkers (Chapter 3.3). The group of secondary input-derived biomarkers comprises zooplankton- and bacteria-specific fatty acids (Chapter 3.3). Both groups are used to trace the input of MOM into surface sediments of the East Greenland continental margin. Algae-specific fatty acids are main compounds of primary production-derived biomarkers and variations in primary production-derived biomarkers are caused by variations in algae-specific fatty acids. Highest amounts of algae-specific fatty acids are measured in samples of the *Coastal Zone* but their concentrations vary strongly in adjacent stations as well as in different fjords (Table 6.2). On each cross-margin transect the amounts of algae-specific fatty acids significantly decrease in stations of the *Ice Covered Zone* and the concentrations slightly increase towards the *Marginal Ice Zone* (Figures 7.6-7.8). Both other primary production-derived biomarkers show contrasting distributions. Short-chain *n*-alkanes in the *Coastal Zone* show highest variability, but in general, their concentrations are comparable to short-chain *n*-alkane concentrations in the *Ice Covered Zone*. The amounts of short-chain *n*-alkanes increase slightly in samples of the *Marginal Ice Zone*. Brassicasterol reach comparable high concentrations in the *Coastal Zone* and the *Marginal Ice Zone* whereas concentrations in the *Ice Covered Zone* are reduced.

The distribution of primary production-derived biomarkers along Transect IV provides another pattern (Figure 7.9). Algae-specific fatty acids reach comparable high concentrations in samples of the *Ice Covered Zone* as well as of the *Marginal Ice Zone* and the *Seasonally Open Water Zone*. In contrast, variations occur in the concentrations of short-chain *n*-alkanes and brassicasterol in the three different zones. Amounts of both are low in the *Ice Covered Zone*, increase towards the *Marginal Ice Zone* and decrease in samples of the *Seasonally Open Water Zone*. Station PS62/017 of the *Seasonally Open Water Zone* do not fit in this general distribution pattern and it can be assumed that special regional conditions are responsible for the unexpected high concentrations of all biomarkers.

Secondary producers like herbivorous zooplankton, bacteria and benthic organisms consume the primary-produced organic matter, transferring it to a higher level in the food chain (Sakshaug, 2004; Loeng et al., 2005). Consequently, the group of secondary input-derived biomarkers contain zooplankton- and bacteria-derived fatty acids (Chapter 3.3). High amounts of secondary input-derived biomarkers are measured in samples of the *Coastal Zone* and their amounts decrease on each cross-margin transect in the *Ice Covered Zone* (Table 6.2; Figures 7.6-7.8). In the *Marginal Ice Zone* the concentrations of secondary input-derived biomarkers increase again. On Transect IV along the East Greenland continental margin secondary input-derived biomarkers show a distribution pattern similar to that of short-chain *n*-alkanes and brassicasterol (Figure 7.9). Low concentrations occur in the *Ice Covered Zone* and values increase in the *Marginal Ice Zone* before they slightly decrease in the *Seasonally Open Water Zone*.

The distribution of primary production- and secondary input-derived biomarkers is primarily affected by variations in primary production and grazing efficiency of secondary producers. In the Young Sound, an East Greenland fjord, the annual pelagic primary production is generally low (10 g C/m^2; Rysgaard et al., 1999) (Figure 7.1). Even though benthic primary production can be an important contributor to the aquatic primary production in shallow Arctic waters, the benthic primary production only accounts for at least 1/3 of the aquatic primary production (Glud et al., 2002). The annual primary production in permanently ice-covered Arctic waters is about 15 to 20 g C/m^2 (Gosselin et al., 1997; Pomeroy, 1997). A significant higher annual primary production (81-85 g C/m^2) is estimated for the Greenland Sea (von Bodungen et al., 1995; Richardson et al., 2005). Thereby the highest primary production values are recorded from the marginal ice zone showing values 2-3-fold higher than the average for open water stations (Richardson et al., 2005). Very high amounts of algae-specific fatty acids and short-chain *n*-alkanes in sea-ice samples from the Greenland Sea suggests that melting sea ice is another important source, contributing to the annual primary production. Even though the annual primary production in sea ice is low (0.6 g C/m^2; Legendre et al., 1992) it may contribute a considerable fraction of annual primary production as most of the ice melt (71%) takes places in the *Marginal Ice Zone* between 76 and 75°N (Wheeler, 1996; Aagaard et al., 1999; Gradinger et al., 1999; Martin and Wadhams, 1999). However, the annual primary production stands in contrast to the distribution of primary production-specific biomarkers. In the area of high primary production (*Marginal Ice Zone*) primary production-derived biomarkers show low concentrations whereas areas of low primary production (*Coastal Zone*) have significant higher concentrations of primary production-derived biomarkers. Consequently, other factors must control the distribution of primary production-specific biomarkers in marine sediments.

An efficient grazing of the primary production by secondary producers reduces the amount of primary production-derived biomarkers in surface sediments. In principle, grazing by organisms and the vertical transport are competing processes. Generally, the primary and secondary production show an inverse relationship, that is the more phytoplankton is grazed by zooplankton, the less of the primary production is vertically transported to the sea floor and vice versa. When phytoplankton blooms and zooplankton stocks coincide in space and time, the grazing efficiency is large (match) and vertical transport small. Conversely, when phytoplankton blooms and zooplankton stocks are separated in time and space, grazing efficiency is small (mismatch) and vertical transport large (Sakshaug, 2004; Loeng et al., 2005). But also the impact of grazing zooplankton on the vertical transport of primary production-specific biomarkers stands in contrast to the distribution of primary production-specific biomarkers in surface sediments. In Young Sound a very tight and effective coupling (match) between pelagic primary production and secondary production exists and the grazing impact from copepods amounts to 85 to 104% of the annual primary production (Rysgaard et al., 1999). In contrast, the early development of phytoplankton relative to zooplankton stocks promotes a decoupling (mismatch) of phytoplankton growth from mineralisation by herbivorous mesozooplankton in the ice-covered and open waters of the Greenland Sea (Hirche et al., 1991; Wassmann et al., 1996, 2004). The corresponding grazing rate in the Greenland Sea is likely to be lower than 60% of the total primary production (Sakshaug, 2004). The differences in grazing efficiency of zooplankton stocks on phytoplankton blooms between the *Coastal Zone* and the *Ice Covered Zone*, *Marginal Ice Zone* and *Seasonally Open Water Zone*, are not reflected in the correlation chart of algae-specific fatty acids versus zooplankton- and bacteria-specific fatty acids (Figure 7.10) and in the spatial distribution of secondary input-derived biomarkers. The high positive correlation between primary production- and secondary input-derived fatty acids in the *Ice Covered Zone*, *Marginal Ice Zone* and *Seasonally Open Water Zone* points to a mismatch of phytoplankton blooms and zooplankton stocks in these areas. However, even in samples of the *Coastal Zone* a positive correlation between primary production- and secondary input-derived fatty acids exists, indicating a low grazing efficiency of zooplankton stocks on phytoplankton blooms.

While zooplankton- and bacteria-specific fatty acids in the *Coastal Zone* are at about 30% of the algae-specific fatty acids, in the *Ice Covered Zone* and the *Marginal Ice Zone* the zooplankton- and bacteria-specific fatty acids are about 70 to 90% of the algae-specific fatty

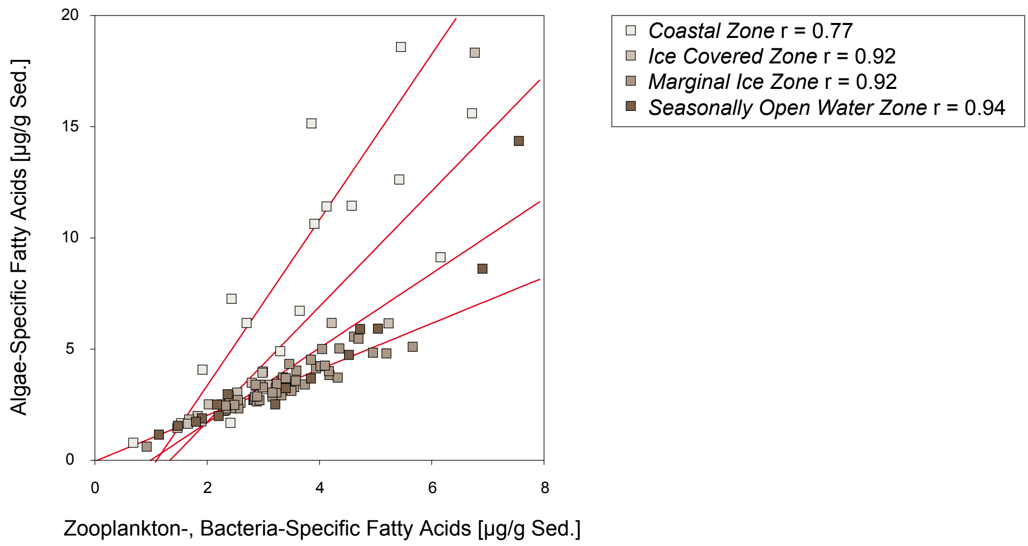


Figure 7.10 Correlation chart of algae-specific fatty acids versus zooplankton- and bacteria-specific fatty acids in samples of the marine zones of the East Greenland continental margin. For zone assignment of samples see Appendix A (r=correlation coefficient).

acids (Table 6.2). The low percentage in the *Coastal Zone* points to a high and effective vertical transport of primary production-derived biomarkers and a low grazing efficiency of zooplankton, which stands in contrast to the investigations in Young Sound. Presumably, the situation in Young Sound, where biological investigations were performed by Rysgaard et al. (1999) and Glud et al. (2002), is not representative for all East Greenland fjord systems. The great patchiness in distribution of bulk parameters and biomarkers confirms this assumption. In contrast, the relative high percentage of zooplankton- and bacteria-specific fatty acids in the *Ice Covered Zone* and the *Marginal Ice Zone* is unexpected high and cannot be explained with the distribution of primary productivity and grazing by organisms. Consequently, other factors than primary and secondary production control the distribution of organic carbon at the East Greenland continental margin.

7.2.4 Terrigenous Supply of Organic Matter

Two possible major source areas are to be considered for the supply of TOM into marine sediments of the East Greenland continental margin. On one side the terrigenous material may originate from East Greenland where a high volume of sediment-laden meltwater is discharged from outlet glaciers of the Greenland Ice Sheet into the East Greenland fjord systems (Evans et al., 2002; Smith et al., 2002). The fluvial input, the input through coastal erosion, and the aeolian sediment supply are of minor importance on the East Greenland continental margin. The other possible source for the supply of TOM is the melting sea ice. The sea ice of the Greenland Sea mainly consists of multi-year pack ice originating from the Siberian shelf seas (e.g., Laptev Sea and Kara Sea) (Pfirman et al., 1997; Dethleff et al., 2000; Eicken et al., 2000). Sediments, consisting approximately by two-thirds of lithogenic and one-third of biogenous matter, get incorporated in the sea ice during its formation in the shallow shelf regions (Wollenburg, 1993; Nürnberg et al., 1994; Lisitzin, 2002; Dethleff, 2005). The biogenous part mainly consists of marine diatoms and to a minor part of other marine organisms and also of terrigenous organic matter (Abelmann, 1992; Nürnberg et al., 1994; Falk-Petersen et al., 1998; Henderson et al., 1998). Ocean currents transport the ice within 3 to 4 years to the Fram Strait where it enters the Greenland Sea (Pfirman et al., 1997). The main part (71%) of the ice melts between 76 and 75°N (Martin and Wadhams, 1999) and the incorporated lithogenic and biogenous particles are released (Ramseier et al., 2001).

The C/N-ratios and the Rock-Eval Pyrolysis parameter give information about the supply of TOM (Chapter 3.1.1 and 3.1.2). In *Coastal Zone* sediments C/N-ratios are highest and range from 5 to 14, indicating a mixture of aquatic organic matter (AOM) and TOM (Table 6.1; Figure 6.11). The AOM is assumed to be predominately of marine origin because only a few meltwater rivers without a significant organic matter content discharge into the *Coastal Zone* (Rasch et al., 2000). The TOM is probably part of the sediment-laden meltwater, which is discharged from outlet glaciers of the Greenland Ice Sheet. Depending on the hinterland geology, more or less TOM enters the different fjord systems. The C/N-ratios of the *Ice Covered Zone*, *Marginal Ice Zone* and *Seasonally Open Water Zone* are generally lower, showing also a lower variability (6-8) (Table 6.1; Figure 6.11). These lower values indicate a strong influx of aquatic organic matter but it does not rule out a terrigenous origin of a portion of the organic matter. The C/N-ratios of the *Sea-Ice Zone*, ranging around 9, are evidence of a mixture of AOM and TOM, originating from ice-transported sediments. However, partly low TOC and nitrogen concentrations, slightly above the detection limit of the analysers, demand for caution in interpreting C/N-ratios.

A different result for the distribution of TOM is obtained from the results of the Rock-Eval Pyrolysis. In general, all marine sediments are characterised by low HI(S1+S2)' values (<150 µg HC/g TOC), very high OI values (>300 µg CO_2/g TOC), and T_{max} values below 430°C

(Table 6.1), indicating predominantly immature TOM in all zones (Tissot and Welte, 1984; Stein and Macdonald, 2004a). A more detailed characterisation of the organic matter and a differentiation of marine zones based on the modified hydrogen index are not possible. The oxygen index is normally not used to characterise the organic matter in immature sediments, but the pronounced gradient in distribution suggests that the organic carbon in sediments of the *Marginal Ice Zone* and northern *Seasonally Open Water Zone* is of a different origin than the organic carbon in sediments of the other marine zones (Figure 6.14). The same trend as in the distribution of OI is observed in the distribution of T_{max}(Figure 6.16). Sediments of the *Marginal Ice Zone* are characterised by temperatures between 400 and 430°C while values in other marine zones mainly range from 325 to 375°C. To estimate the relevance of East Greenland and sea ice as sources for TOM in sediments of the East Greenland continental margin, the interpretation of higher plant-derived biomarkers is a useful tool.

Higher plant-derived biomarkers, containing long-chain *n*-alkanes, long-chain fatty acids and higher plant-specific sterols (Chapter 3.3), are used to trace the input of TOM into surface sediments. The concentrations of long-chain *n*-alkanes and long-chain fatty acids are lowest in the *Coastal Zone* and they increase over the *Ice Covered Zone* towards the *Marginal Ice Zone*. The higher plant-specific sterols campesterol, stigmasterol and β-sitosterol show a different distribution (Table 6.2; Figures 7.6-7.8). Their concentrations in the *Coastal Zone* and the *Marginal Ice Zone* are comparable high and lower amounts are detected in the *Ice Covered Zone*. The increase of higher plant-derived biomarkers in the *Marginal Ice Zone* is also observable on transect IV along the East Greenland continental margin (Figure 7.9). Long-chain *n*-alkanes, long-chain fatty acids and higher plant-specific sterols have low concentrations in the *Ice Covered Zone*. Their amounts increase towards the *Marginal Ice Zone* where highest concentrations are measured. In the *Seasonally Open Water Zone* the amounts of higher plant-derived biomarkers decrease with increasing distance to the ice edge.

The assumption that long-chain fatty acids are of terrigenous origin is supported by the high positive correlation of long-chain fatty acids with long-chain *n*-alkanes (Figure 7.11) as compound-specific carbon isotope analysis of long-chain *n*-alkanes prove that these compounds are of terrigenous origin (Figure 6.30). The compound-specific carbon isotope analysis of long-chain *n*-alkanes also point to two different sources for these compounds in sediments of the East Greenland continental margin. Samples of the *Coastal Zone*, which are

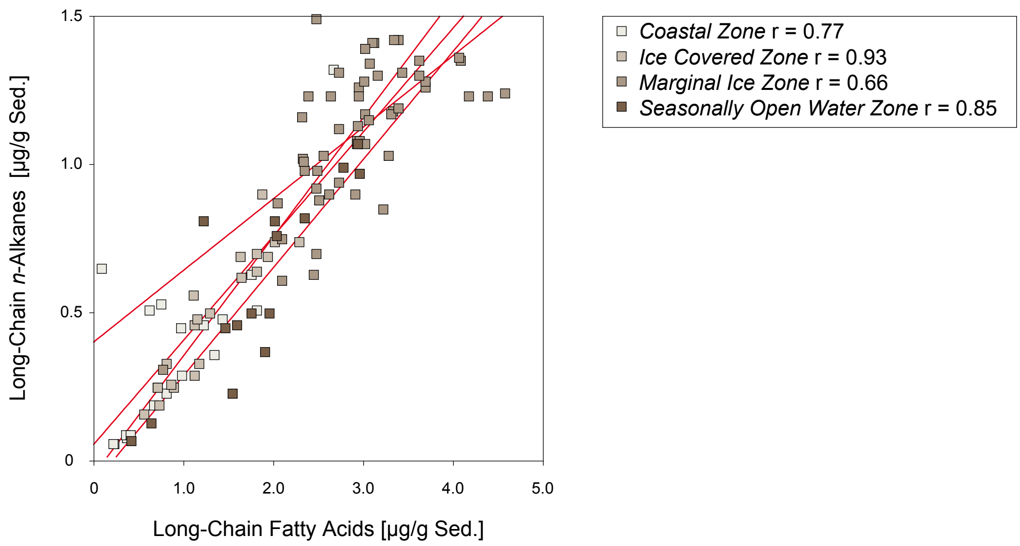


Figure 7.11 Correlation chart of long-chain *n*-alkanes versus long-chain fatty acids in samples of the marine zones of the East Greenland continental margin. For zone assignment of samples see Appendix A (r=correlation coefficient).

characterised by the supply of terrigenous sediments originating from Greenland, have higher $\delta^{13}C$ values (e.g., *n*-C_{29}=-32.3 to -29.1‰) than samples of the *Marginal Ice Zone* and the *Seasonally Open Water Zone* (e.g., *n*-C_{29}=-33.2 to -33.0‰), that are characterised by the input of terrigenous material from melting sea ice. The $\delta^{13}C$ values of the *Ice Covered Zone* (e.g., *n*-C_{29}=-33.6 to -30.8‰) show that this zone is affected by the input of terrigenous material from Greenland as well as from melting sea ice.

The low amounts of long-chain *n*-alkanes and long-chain fatty acids in the *Coastal Zone* indicate that Greenland seems not to be a significant source for the input of these terrigenous compounds. As the concentrations of long-chain *n*-alkanes and long-chain fatty acids increase significantly in the *Marginal Ice Zone*, the melting sea ice is considered to be the most important source for the input of TOM into sediments of the East Greenland continental margin. The relevance of the sea ice for the supply of TOM is emphasised by the very high concentrations of long-chain *n*-alkanes and long-chain fatty acids in the *Sea-Ice Zone*.

The higher concentrations of higher plant-specific sterols in the *Coastal Zone* as well as in the *Marginal Ice Zone* and the reduced concentrations in the *Ice Covered Zone* and *Seasonally Open Water Zone* suggest that these compounds are entrained in comparable concentrations directly from Greenland as well as from melting sea ice. However, their concentrations are low compared to the concentrations of long-chain *n*-alkanes and long-chain fatty acids. In general, more TOM compared to MOM is detected in the *Marginal Ice Zone* than one would expect with regard to the values of marine production of organic matter in surface waters and the values for the terrigenous supply of organic matter by melting sea ice. Consequently, the composition of the organic matter in surface sediments must be the result of the flux and degradation of organic carbon in the water column and the degradation of organic matter at the sediment-water interface.

7.2.5 Flux of Organic Carbon in the Water Column

The flux of organic matter, MOM as well as TOM, is influenced by particle aggregation dynamics and alteration processes in the water column. Large, rapidly sinking particles like faecal pellets, marine snow and terrigenous particles are responsible for the majority of the downward vertical transport of organic matter (Bruland et al., 1989; Alldredge and Jackson, 1995; Alldredge, 2001; Lampitt, 2001). Rapidly sinking particles are produced via biologically and physically mediated aggregation processes. Zooplankton produces faecal pellets via biologically mediated aggregation of consumed small particles. Marine snow consists of aggregates of highly diverse origins, structures, and characteristics and it includes fragile, porous, loose associations of smaller particles, highly cohesive, robust gelatinous webs produced by zooplankton, and flocculent, porous faecal pellets. The aggregation of marine snow occurs through physically mediated processes of collision and sticking (Alldredge, 2001; Lampitt, 2001). The supply of fine-grained terrigenous lithogenic and organic particles enhances the formation of marine snow. The formation of large, rapidly sinking particles, containing MOM and TOM, leads to higher sedimentation rates and to a shorter residence time of the material in the water column. In summary, it can be ascertained that high amounts of terrigenous particles foster the preservation of MOM ("ballast effect") (Ittekkot et al., 1992; Knies and Stein, 1998).

In general, the "ballast effect" seems to be of minor importance at the East Greenland continental margin. Indeed samples from the *Marginal Ice Zone* show higher concentrations of primary production- and secondary input-derived biomarkers in combination with higher amounts of higher plant-derived biomarkers in comparison to samples of the *Ice Covered Zone*, but the *Marginal Ice Zone* is also characterised by a significant higher primary and secondary production (Figures 7.6-7.9). Anyway, the "ballast effect" does not influence the distribution of MOM in surface sediments of the East Greenland continental margin.

7.2.6 Degradation of Organic Carbon in the Water Column and at the Sediment-Water Interface

The most important processes, controlling the distribution of biomarkers, are the degradation of the organic matter in the water column as well as at the sediment-water interface. Here, the MOM seems to be more affected by degradation processes than TOM as the enhanced input of TOM by melting sea ice can be traced in surface sediments whereas the enhanced primary and secondary production at the *Marginal Ice Zone* is not reflected in surface sediments. This assumption is supported by the results of several studies of degradation processes. In general, the flux of organic matter decreases with depth, as sinking particles disaggregate and decompose (Berger et al., 1989; Alldredge, 2001). A small amount of the biological production gets exported from surface waters and sinks through the water column to the sea floor. Degradation processes in the water column and at the sediment-water interface lower the amount of organic matter even more and finally only a small fraction is preserved in the sediment (Berger et al., 1989; Bruland et al., 1989; Jumars et al., 1989; Williams et al., 1989) (Figure 7.12).

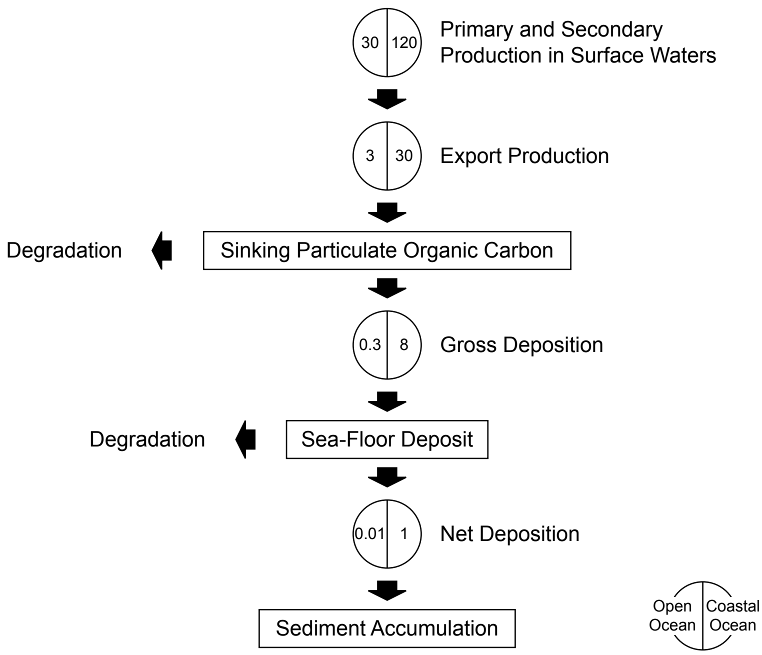


Figure 7.12 Sketch of transfer of particulate organic carbon in the ocean, from primary production to burial in the sediment. Numbers are fluxes in g $C/m^2 a$ (left value: typical open ocean value; right value: typical coastal ocean value) (modified after Berger et al., 1989).

However, a series of sediment trap experiments have shown that decomposition and transformation rates vary depending on the molecular structure of individual compounds (Wakeham and Lee, 1993 and references therein). Fatty acids are the most labile compounds, having a half-depth of 779 m, sterols are less labile and have a half-depth of 837 m whereas hydrocarbons have a half-depth of 1222 m (Wakeham et al., 1980; Gagosian et al., 1982; Wakeham, 1982; De Baar et al., 1983; Wakeham et al., 1984) (Figure 7.13). Investigations of Gagosian et al., 1983, Volkman et al., 1983 and Wakeham et al., 1983 have shown that marine-derived compounds are usually more reactive than terrestrial-derived compounds. Also during degradation at the sediment-water interface marine-derived organic matter exhibit about 5 times the reactivity of terrigenous-derived organic matter (Prahl et al., 1980; Furlong and Carpenter, 1988; Hedges et al., 1988).

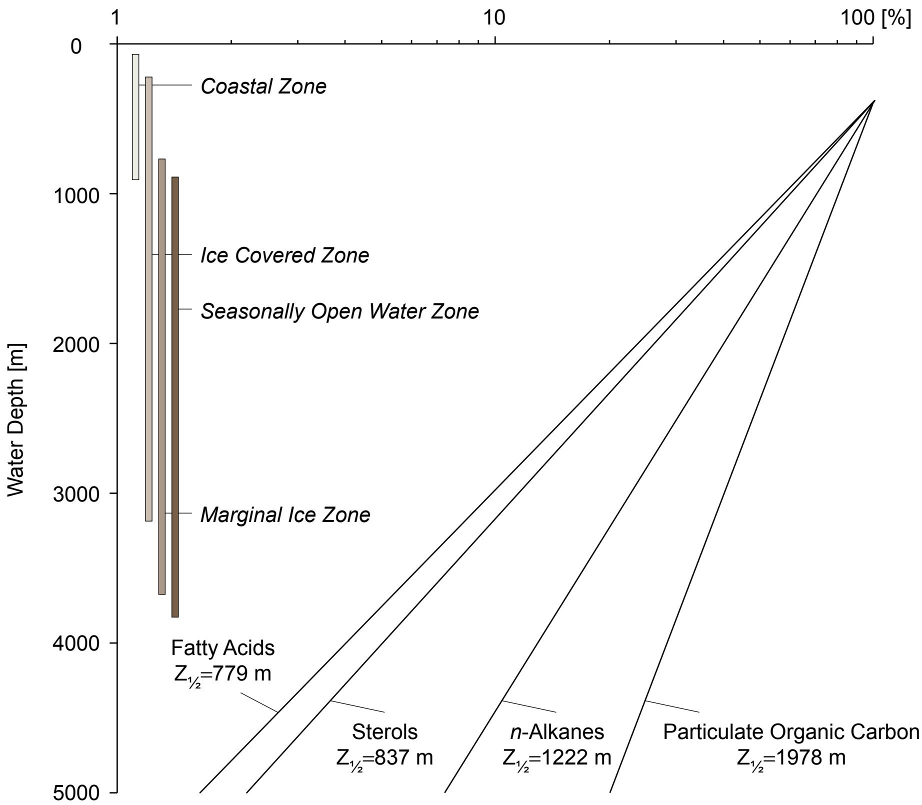


Figure 7.13 Vertical fluxes of particulate organic carbon, *n*-alkanes, sterols and fatty acids in relation to water depth. Export fluxes at 400 m water depth are defined as 100%. Columns indicate the depth distribution of samples of the marine zones. $Z_{½}$ are calculated half-depths (modified after Wakeham and Lee, 1993).

The differential behaviour of specific organic compound classes is observed in samples of the East Greenland continental margin. The *Coastal Zone* exhibits highest concentrations of primary production- and secondary input-derived biomarkers even though the primary and secondary production is low in comparison to the *Marginal Ice Zone*. Due to the shallow water depth, only a relative small amount of the MOM seems to be degraded during transit through the water column. In contrast, samples of the deep sea (*Ice Covered Zone*, *Marginal Ice Zone*, *Seasonally Open Water Zone*) generally have lower concentrations of MOM as assumed due to primary production rates. Algae-specific fatty acids are presumably strong degraded in deep-sea sediments as no enhanced concentrations are observed in the *Marginal Ice Zone* (Figure 6.23). However, higher concentrations of short-chain *n*-alkanes can be traced in the same sediments. That confirms the assumption of a compound-specific degradation of the organic matter.

7.2.7 Impact of Preservation, Dilution and Winnowing on the Distribution of Organic Carbon in Sediments

Additionally, the concentration and composition of organic carbon in surface sediments is affected by variations in sedimentation rate and grain-size distribution (Müller and Suess, 1979; Berner and Wefer, 1990; Stein, 1990; Hedges and Keil, 1995). The portion of primary produced organic carbon preserved in sediments is universally related to the sedimentation rate. Accordingly, 0.1 to 2% of the primary production becomes fossilised in moderately rapidly accumulating hemipelagic sediments (2 to 13 cm/ka) and 11 to 18% in rapidly accumulating sediments (66 to 140 cm/ka) (Müller and Suess, 1979). This effect can be explained by the fact that high sedimentation rates favour the preservation of MOM by reducing its residence time at the sediment-water interface where degradation processes take place (Stein, 1990; Sauter et al., 2001). In areas of extremely high sedimentation rates (>1000 cm/ka) the dilution effect exceeds the preservation effect of organic carbon (Stein, 1990; Hedges and Keil, 1995). Consequently, the very high sedimentation rates lower the amount of MOM in sediments. The sedimentation rate on the East Greenland continental margin is spilt into two parts. As mentioned above, the *Coastal Zone* is characterised by high sedimentation rates ranging between 90 and 250 cm/ka (Evans et al., 2002; Smith et al., 2002). These sedimentation rates foster the preservation of MOM and the dilution effect seems to be irrelevant as the enhanced concentrations of MOM demonstrate. In contrast, the moderately sedimentation rates of <4 cm/ka (Paetsch et al., 1992; Nam, 1997; Evans et al., 2002) in the other marine zones do not favour an enhanced preservation of MOM and degradation processes lower the amount of preserved organic matter (Müller and Suess, 1979; Hedges and Keil, 1995).

Samples of the outer shelf and the upper slope of the East Greenland continental margin and of the Denmark Strait are influenced by the winnowing effect (Berner and Wefer, 1990). The strong bottom currents related to the EGC and the Denmark Strait Overflow wash out the fine grain sizes of the surface sediments resulting in an enhanced percentage of coarse terrigenous compounds. As the organic matter is absorbed onto mineral surfaces and has a high affinity for fine-grained sediments (Mayer, 1994; Hedges and Keil, 1995), the reduced content of fine-grained sediments causes a reduction of TOC along the shelf break (Figure 7.2).

7.2.8 Origin of Biomarkers in Surface Sediments and Processes Controlling their Distribution

Long-chain *n*-alkanes, long-chain fatty acids and higher plant-specific sterols are assumed to be of allochthonous origin. The high positive correlation of brassicasterol with higher plant-specific sterols points to similar sources for both compounds (Figure 7.14). The most reasonable explanation for this correlation is that brassicasterol is predominately synthesised by freshwater phytoplankton and has therefore the same source as higher plant-specific sterols. Probably both compounds are transported by sea ice from Siberia into the Nordic Seas where melting processes result in the release of both compounds. This assumption is supported by the work of Fahl et al. (2003), which also favours a freshwater origin for brassicasterol. Consequently, brassicasterol accounts for the sum of allochthonous organic matter. Short-chain *n*-alkanes and algae-, zooplankton- and bacteria-specific fatty acids account for the sum of autochthouns organic matter.

Autochthonous biomarkers show highest concentrations in the shallow *Coastal Zone* (Figure 7.15). Degradation processes mainly control their distribution as in the deep sea only low concentrations of autochthonous biomarkers are detected. The marine production is not reflected in surface sediments. Allochthonous biomarkers show highest concentrations in the *Marginal Ice Zone* indicating the predominant input of these compounds by melting sea ice (Figure 7.16). Their concentrations are lower under the permanent ice cover of the *Ice Covered Zone*. The lowest amounts of allochthonous biomarkers in the *Coastal Zone* point to an insignificant input of allochthonous biomarkers directly form Greenland.

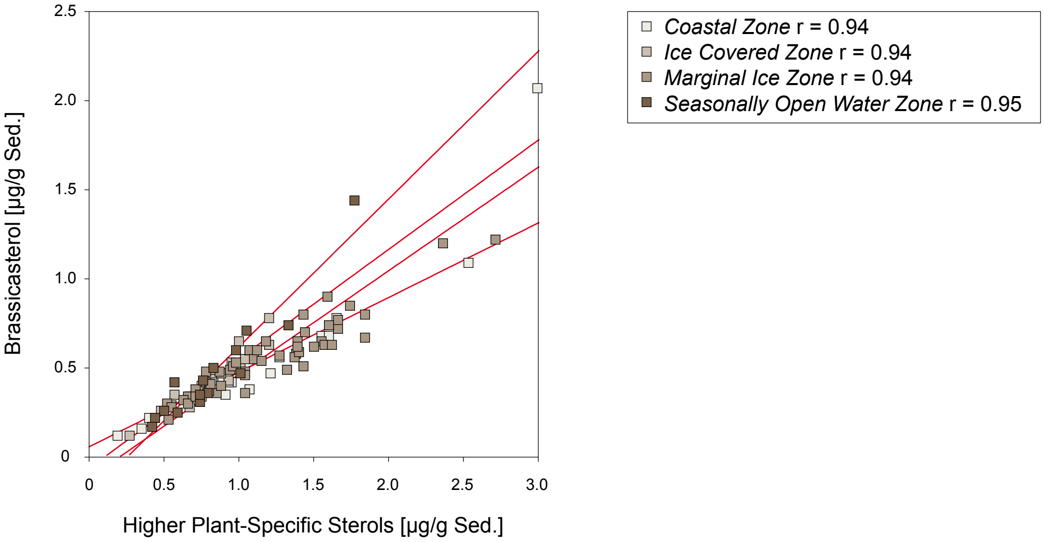


Figure 7.14 Correlation chart of brassicasterol versus higher plant-specific sterols in samples of the marine zones of the East Greenland continental margin. For zone assignment of samples see Appendix A (r=correlation coefficient).

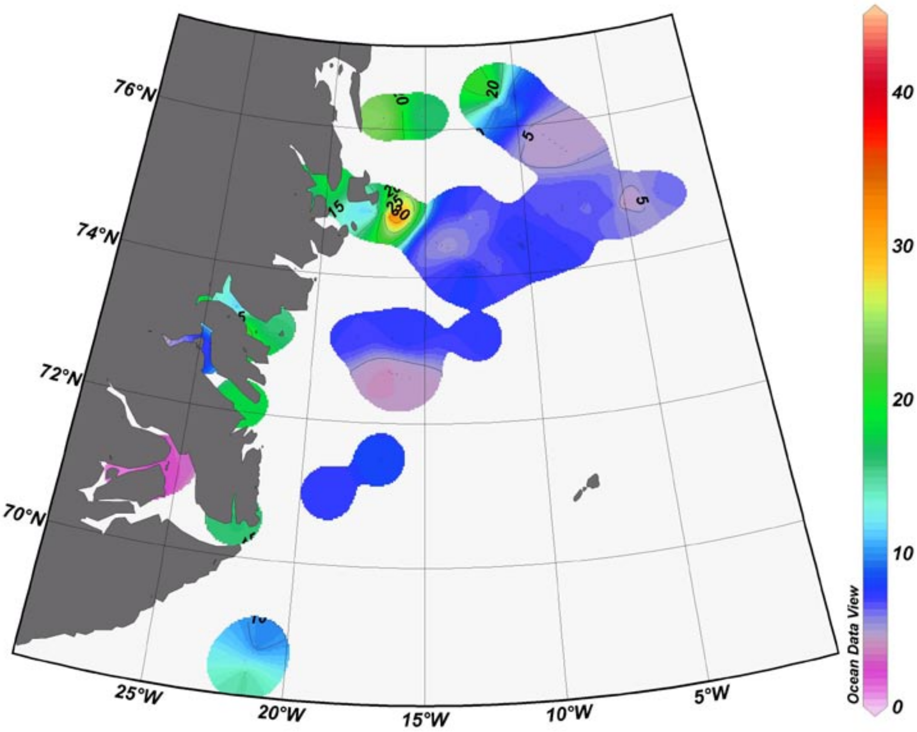


Figure 7.15 Distribution of autochthonous biomarkers (in µg/g Sed.) in surface sediments of the East Greenland continental margin. For sample location see Chapter 6.2.2.

Regarding the relative distribution of autochthonous and allochthonous biomarkers it is obvious that the composition of organic carbon in surface sediments of the East Greenland continental margin is controlled by degradation as a distinct relation between composition and water depth is recognisable (Figure 7.17).

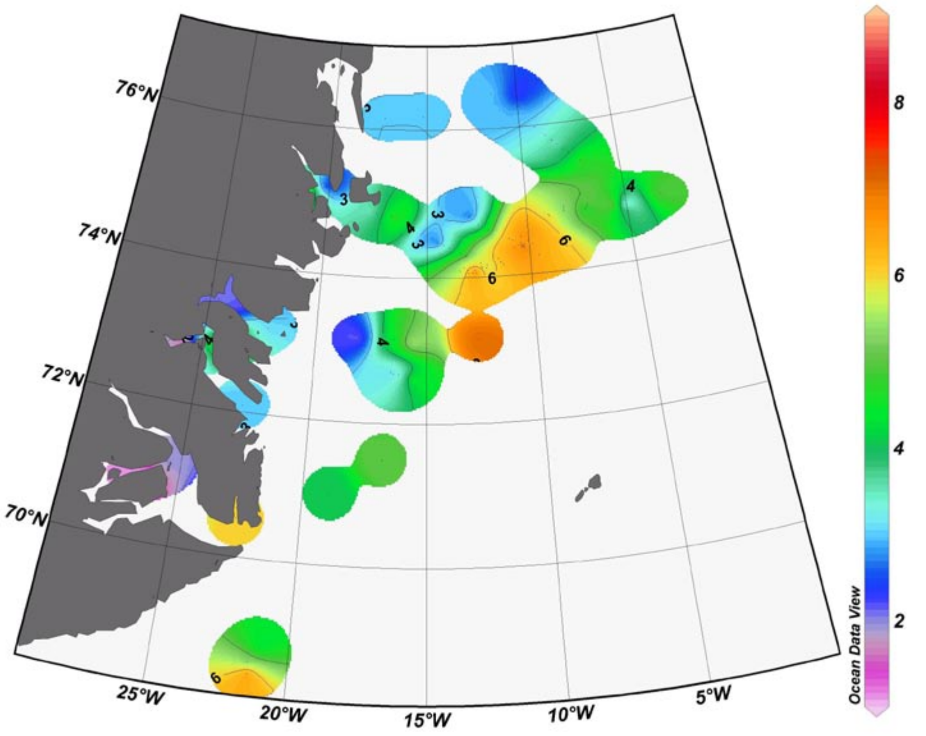


Figure 7.16 Distribution of allochthonous biomarkers (in µg/g Sed.) in surface sediments of the East Greenland continental margin. For sample location see Chapter 6.2.2.

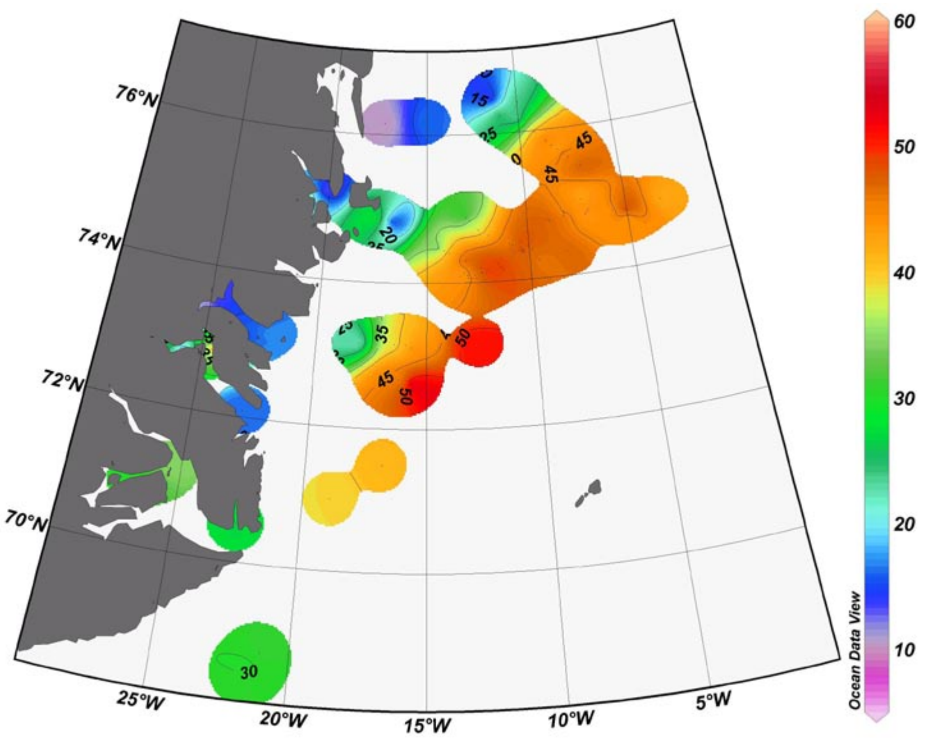


Figure 7.17 Distribution of allochthonous biomarkers (in %) in surface sediments of the East Greenland continental margin. For sample location see Chapter 6.2.2.

7.3 Variations of the Organic Carbon Content during the Late Quaternary

The very low TOC contents of the investigated sediment cores do not allow performing Rock-Eval Pyrolysis and biomarker analysis to characterise the organic carbon. Even the C/N-ratios cannot be used for discussion due to very low nitrogen concentrations near to the detection limit of the analyser. Without a more detailed characterisation of the organic carbon by additional parameters the discussion of its origin and the controlling processes for its input remains preliminary and incomplete. Additionally, the low temporal resolution of the sediment cores PS62/003, PS62/004, PS62/015, and PS62/017 makes it difficult to correlate their organic carbon records and to identify general trends in the sedimentation of organic carbon during the late Quaternary (see Chapter 5). The sediment core PS2644 shows a much higher temporal resolution, especially during marine isotope stage (MIS) 3, and additional parameters like magnetic susceptibility and IRD counts are available (Figure 5.2). In the following, only the TOC records of sediment cores PS62/017 and PS2644 are presented, and a rough model for organic-carbon variability is presented. The discussion mainly focuses on the MIS 3 interval in sediment core PS2644.

Generally, the TOC contents as well as the accumulation of TOC increase at the end of colder periods (i.e., MIS 2 and MIS 4, H1 to H6) (Figure 7.18). The low organic-carbon accumulation rates during MIS 4 lead to the assumption, that during this period the core locations were presumably permanently ice-covered. The permanent ice cover lowered the biological production in surface waters resulting in low contents of MOM in sediments. Additionally, melting of sea ice occurred only on a small scale leading to a low input of TOM. This scenario may explain the low accumulation of TOC during all colder periods. The increasing TOC contents and accumulation rates at the end of colder periods are supposed to be the result of an enhanced input of TOM by melting sea ice, and an enhanced biological production. Additionally, the higher sedimentation rates fostered the preservation of organic matter.

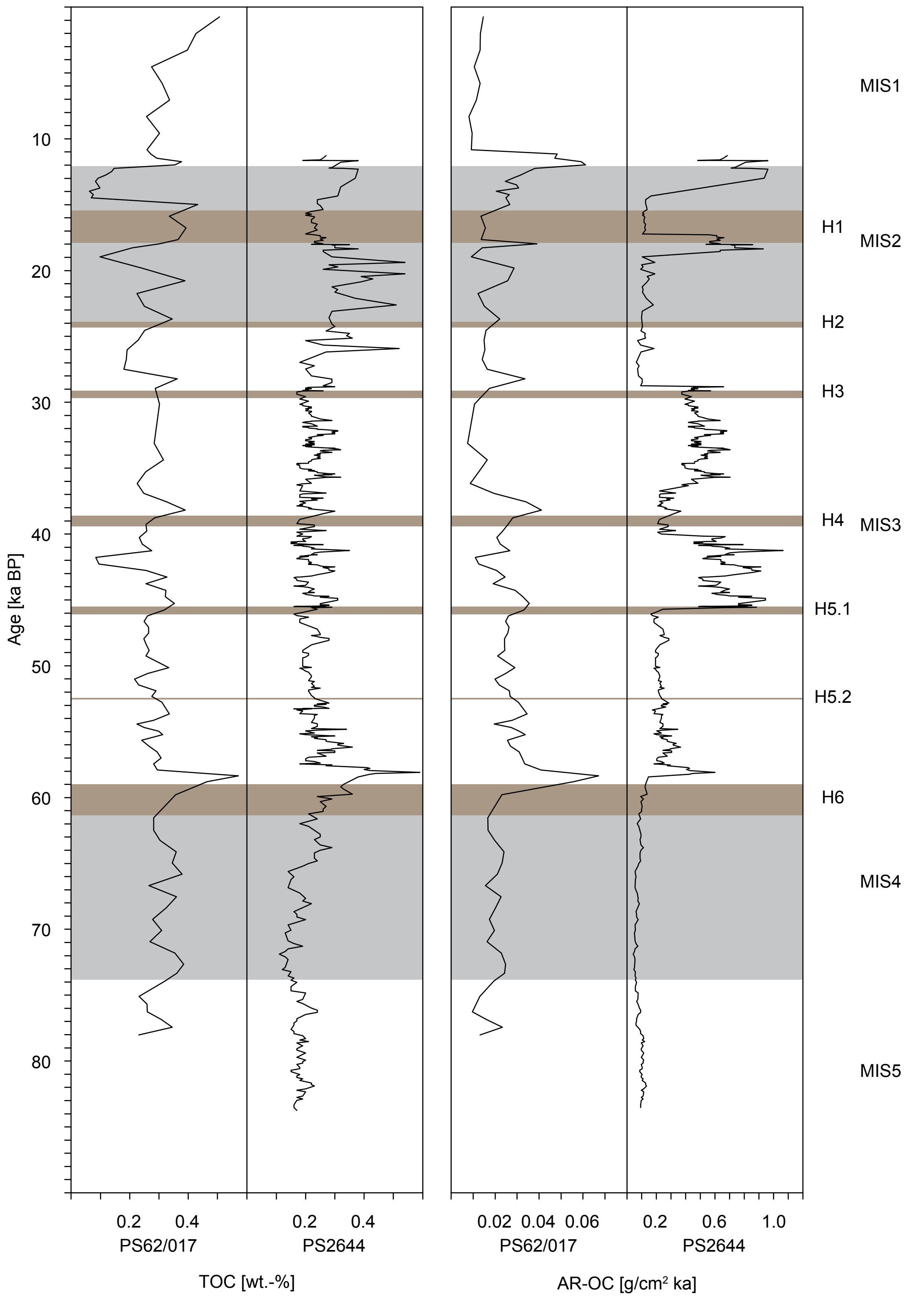


Figure 7.18 TOC contents (wt.-%) and TOC accumulation rates (g/cm^2 ka) of sediment cores PS62/017 and PS2644 versus calendar age (ka BP). Grey bars mark marine isotope stages MIS2 and MIS 4, coloured bars Heinrich events H1-H6, respectively

In general, two different types of TOC maxima are to distinguish in MIS 3 of sediment core PS2644. Both types of TOC maxima correlate well with Dansgaard-Oeschger events. The first type of TOC maxima (type 1) is characterised by carbonate maxima, magnetic susceptibility minima and IRD maxima (Figure 7.19). The type 1 TOC maxima occur during the transition from stadial to interstadial conditions at Dansgaard-Oeschger events 5-8, 10, 11 and 17. The Dansgaard-Oeschger interstadials are characterised by the inflow of relatively warm Atlantic surface waters through the Denmark Strait into the Nordic Seas inside the Irminger Current leading to seasonally ice-fee conditions at the position of core PS2644 (Voelker, 1999). Presumably, an enhanced marine production related to the marginal ice zone occurs resulting in the enhanced input of MOM. The enhanced carbonate contents and abundance of radiolarians (Lein, 1998) foster the assumption that an enhanced marine production takes place. The impact of organic matter degradation is assumed to be low due to the shallow water depth of the core location (777 m) and the high sedimentation rates during MIS 3 (up to 100 cm/ka). Additionally, the IRD maxima point to a significant melting of icebergs and sea ice leading to the release of the incorporated terrigenous sediments, including TOM. Therefore, the TOC maxima of type 1 probably represent a mixture of TOM and MOM.

Also the type 2 TOC maxima are assumed to be the result of an enhanced input of TOM and MOM but differences occur. In contrast to type 1, the type 2 TOC maxima are characterised by medium carbonate contents, magnetic susceptibility minima and IRD minima (Figure 7.19). They appear during the fully interstadial section of the Dansgaard-Oeschger cycles 12 and 16. The lower carbonate contents as well as the lower abundance of planktic foraminifera (Voelker, 1999) in accordance with the enhanced abundance of radiolarians (Lein, 1998) point to a different composition of plankton communities during type 2 TOC maxima. Nevertheless, MOM is produced and preserved in the sediment record. The lower IRD contents do not inevitably mean that less terrigenous material and TOM is introduced by melting icebergs and sea ice. Probably, the ice-transported sediments consist predominantly of fine-grained sediments with a high percentage of TOM. Under this assumption the conditions during the interstadial sections of the Dansgaard-Oeschger cycles 12 and 16 are presumably comparable to modern conditions of the *Marginal Ice Zone*.

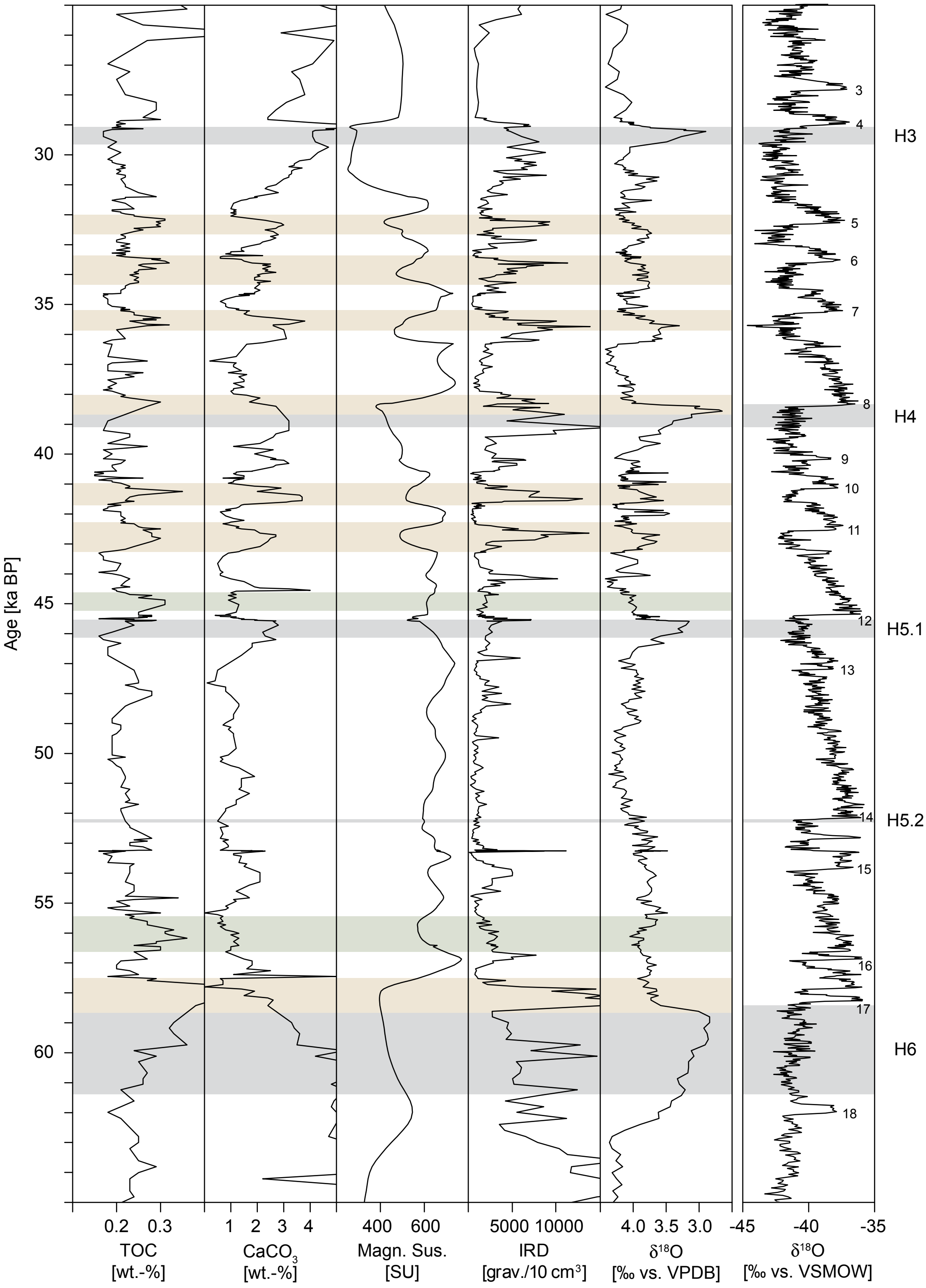


Figure 7.19 TOC and carbonate contents (both in wt.-%) (Stein, unpublished), magnetic susceptibility values (SU) (Niessen and Henschel, 1995), IRD contents (gravel/10 cm³) (Grobe, 1996) and planktic foraminifera (*N. pachyderma*) δ¹⁸O values (‰ vs. VPDB) (Voelker, 1999) of sediment core PS2644 versus calendar age (ka BP), compared to δ¹⁸O (‰ vs. VSMOW) record of Greenland ice core GISP2 (Grootes and Stuiver, 1997). Numbers at GISP2 record mark Dansgaard-Oeschger interstadials, grey bars Heinrich events H3-H6, coloured bars TOC maxima type 1 and type 2, respectively.

8 Concluding Remarks

The distribution of organic matter in surface sediments of the Nordic Seas was investigated, and its controlling processes were discussed. The new data from the investigated surface samples allowed proposing a model for the input and burial of organic carbon at the ice-covered polar continental margin of East Greenland for the first time. With organic-geochemical bulk parameters such as C/N-ratios and the results of the Rock-Eval Pyrolysis a preliminary characterisation of the organic matter was conducted. The additional biomarker investigations provided a substantial database for a more detailed characterisation and for the determination of the origin of organic carbon. In conclusion, the following model for the input and preservation of organic matter in surface sediments of the East Greenland continental margin is proposed:

The *Coastal Zone* is characterised by a relative low primary and secondary production in surface waters during summer and a nearly negligible input of terrigenous organic matter (TOM) by sediment-laden meltwater from outlet glaciers of the Greenland Ice Sheet. The marine organic matter (MOM) sinks to the sea floor and due to the shallow water depth and the related short residence time of MOM in the water column only a relative small portion is affected by degradation. The high sedimentation rates provide a quick embedding of the organic carbon into the sediments and reduce the impact of degradation at the sediment-water interface. As a result, MOM reaches high concentrations in sediments of the *Coastal Zone* whereas TOM occurs only in small amounts.

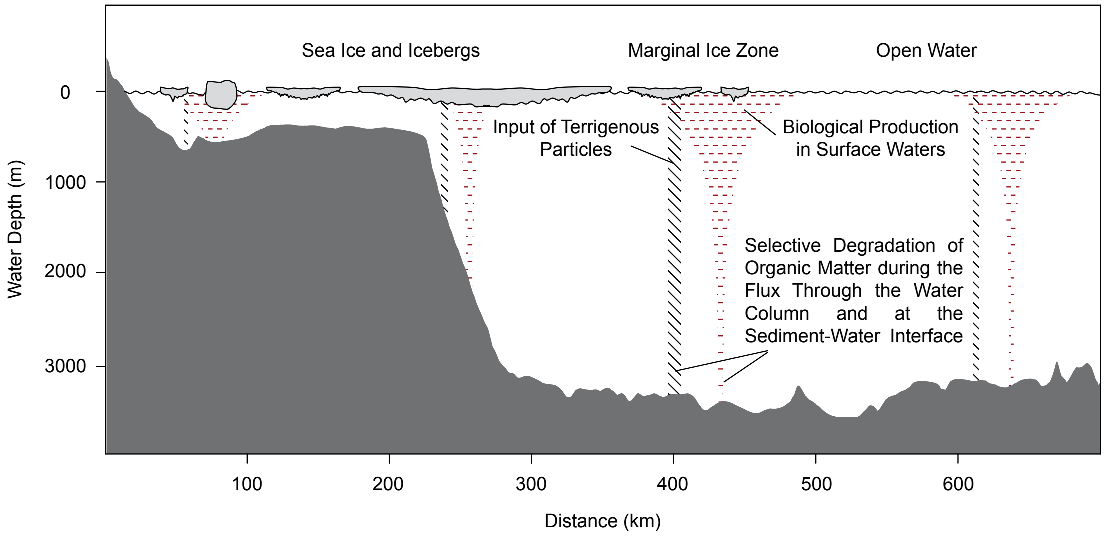
In contrast, the *Marginal Ice Zone* exhibits high primary and secondary production rates. Additionally, the melting sea ice releases high amounts of TOM. Even though the TOM fosters the forming of large, rapidly sinking particles, consisting of TOM and MOM, only small amounts of MOM reach the sea floor. Especially, algae- and zooplankton-/bacteria-specific fatty acids, the predominant compound classes of MOM, are susceptible to degradation processes and therefore most of the MOM is degraded during transit through the water column. The low sedimentation rates cause a long residence time of the organic matter at the sediment-water interface leading to an advanced degradation of the MOM. Degradation processes less affect the TOM and therefore it comes to a relative enrichment of TOM in comparison to MOM in sediments of the *Marginal Ice Zone*.

Comparable processes with slightly variations control the distribution of TOM and MOM in sediments of the *Ice Covered Zone* and the *Seasonally Open Water Zone*. In the *Ice Covered Zone* the marine production of organic matter is lower than in the *Marginal Ice Zone* and also less TOM is introduced by melting sea ice. This is expressed by reduced concentrations of TOM in surface sediments. The amount of MOM in sediments of the *Ice Covered Zone* is comparable to the amount of MOM in sediments of the *Marginal Ice Zone* as the distribution of MOM is mainly controlled by degradation of the MOM in the water column and therefore linked to water depth. Consequently, also the deep-sea sediments of the *Seasonally Open Water Zone* exhibit low concentrations of MOM. However, higher concentrations of TOM are measured in the *Seasonally Open Water Zone* than in the *Ice Covered Zone*. The higher concentrations occur due to lateral, current-controlled transportation processes, transporting TOM from the *Marginal Ice Zone* further to the South, and due to the melting of the seasonally ice cover in spring, resulting in a limited enhanced input of TOM. Figure 8.1 shows a summary diagram of important factors controlling the distribution of organic carbon in the different marine zones of the East Greenland continental margin and their implications on the composition of the organic carbon.

The biomarker analyses have shown that the distribution and composition of organic carbon in sediments of the East Greenland continental margin is strongly influenced by different climate-induced environmental parameters. For the interpretation, source-specific biomarker were summarised in three general groups. In this study, the assignment of individual compounds to the different groups is based on literature data and compound-specific stable carbon isotope analyses of *n*-alkanes. Additional compound-specific stable carbon isotope measurements of the other biomarkers help to reassure this classification. First results suggest that this method can also be used to distinguish between different sources of TOM. Thus, long-chain *n*-alkanes of the *Coastal Zone*, presumably originating from Greenland, show another isotopic signature than long-chain *n*-alkanes of the *Marginal Ice Zone*, which are assumed to be sea ice-derived and therefore originating from Siberia.

Another topic for future research should be the investigation of marine sediment cores of the East Greenland continental margin with organic-geochemical bulk parameters and biomarker analyses. With the knowledge of the processes controlling the modern distribution of organic carbon it is possible to reconstruct the paleoenvironmental conditions for the

East Greenland continental margin. Requirement therefore is the availability of sediment cores with TOC contents high enough to conduct biomarker analysis. A characterisation of paleoenvironmental conditions only based on the interpretation of the sedimentary record of organic carbon remains preliminary and incomplete. However, processes controlling the distribution and composition of organic carbon seems to be comparable through the Late Quaternary. During colder periods the permanent ice cover lowered the biological production resulting in low contents of MOM in sediments; melting of sea ice occured only on a small scale leading to a low input of TOM. During the transition from colder to warmer periods ice breaked up, biological production was enhanced and large amounts of TOM were introduced by melting sea ice.



	Coastal Zone	*Ice Covered Zone*	*Marginal Ice Zone*	*Seasonally Open Water Zone*
Primary and Secondary Production	low PP 10 g C/m^2 a	low PP 15-20 g C/m^2 a	high PP 81-85 g C/m^2 a	medium PP 60 g C/m^2 a
Input of Terrigenous Organic Matter	low	low	high	low
Flux Rate	high 4.0-10.0 g C/m^2 a	very low 0.1-1.0 g C/m^2 a	low 1.0-2.0 g C/m^2 a	low 1.0-2.0 g C/m^2 a
Water Depth	shallow 109-**440**-942 m	medium 253-**1402**-3134 m	deep 850-**3038**-3624 m	medium 910-**1680**-3758 m
Sedimentation Rate	high 90-220 cm/ka	low 4 cm/ka	low 4 cm/ka	low 4 cm/ka
Phytoplankton-Specific Biomarkers	high 11.02 µg/g Sed.	low 4.26 µg/g Sed.	low 4.16 µg/g Sed.	low 4.79 µg/g Sed.
Zooplankton- and Bacteria-Specific Biomarkers	high 3.85 µg/g Sed.	low 2.73 µg/g Sed.	medium 3.30 µg/g Sed.	medium 3.47 µg/g Sed.
Higher Plant-Specific Biomarkers	low 2.44 µg/g Sed.	low 2.62 µg/g Sed.	high 5.27 µg/g Sed.	medium 3.26 µg/g Sed.

Figure 8.1 Summary diagram of important factors controlling the distribution of organic carbon in the different marine zones and their implications on the composition of the organic carbon. Values for primary production, flux rate and sedimentation rate are from literature (von Bodungen et al., 1995; Gosselin et al., 1997; Pomeroy, 1997; Rysgaard et al., 1999; Schlüter et al., 2000; Peinert et al., 2001a; Richardson et al., 2005). Values for water depth are minimum-**mean**-maximum values of investigated sediment samples. Biomarker values are mean values (Table 6.2).

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Table 1 Position, water depth, gear, expedition, and zone assignment of marine surface samples.

Station	Latitude [°N]	Longitude [°E]	Water Depth [m]	Gear	Expedition	Assigned Zone
GIK23424-3	70.335	-0.065	3247	Giant Box Corer	ME 21/4	
GIK23453-1	76.475	8.737	2016	Giant Box Corer	ME 21/4	
GIK23455-2	76.867	8.405	2362	Giant Box Corer	ME 21/4	
GIK23456-6	77.067	6.363	2200	Giant Box Corer	ME 21/4	
GIK23457-3	76.637	6.405	2259	Giant Box Corer	ME 21/4	
GIK23458-3	75.992	6.357	2192	Giant Box Corer	ME 21/4	
GIK23459-2	75.875	5.482	2574	Giant Box Corer	ME 21/4	
GIK23477-1	70.955	-5.557	1713	Giant Box Corer	ME 21/5	
GIK23481-2	67.892	-17.920	1120	Giant Box Corer	ME 21/5	
GIK23482-2	67.890	-18.763	898	Giant Box Corer	ME 21/5	
GIK23483-2	67.860	-18.615	818	Giant Box Corer	ME 21/5	
GIK23484-2	67.935	-18.040	930	Giant Box Corer	ME 21/5	
GIK23486-3	67.915	-18.118	825	Giant Box Corer	ME 21/5	
GIK23487-2	67.338	-14.197	1036	Giant Box Corer	ME 21/5	
GIK23488-1	67.658	-11.077	1841	Giant Box Corer	ME 21/5	
GIK23489-2	67.505	-12.502	1774	Giant Box Corer	ME 21/5	
GIK23548-8	75.000	-0.007	3764	Giant Box Corer	ME 36/3	
GIK23552-8	69.537	-18.997	1261	Giant Box Corer	ME 36/3	
GIK23553-8	69.060	-20.510	1255	Giant Box Corer	ME 36/3	
PS1697-1	73.752	-10.475	2016	Giant Box Corer	ARK-V/3	
PS1698-2	74.177	-14.568	877	Giant Box Corer	ARK-V/3	
PS1703-1	79.755	-14.360	76	Giant Box Corer	ARK-V/3	
PS1706-1	74.217	-10.038	3150	Giant Box Corer	ARK-V/3	
PS1707-1	72.617	-13.840	2118	Giant Box Corer	ARK-V/3	
PS1737-2	73.747	-14.812	1763	Giant Box Corer	ARK-VI/2	
PS1743-2	74.958	4.043	1695	Giant Box Corer	ARK-VI/2	
PS1842-5	69.462	-16.523	982	Giant Box Corer	ARK-VII/1	
PS1843-2	69.468	-16.382	943	Giant Box Corer	ARK-VII/1	
PS1845-2	69.462	-15.763	922	Giant Box Corer	ARK-VII/1	
PS1846-3	69.442	-15.295	1427	Giant Box Corer	ARK-VII/1	
PS1852-1	70.253	-15.823	1105	Giant Box Corer	ARK-VII/1	
PS1855-1	70.600	-14.613	1855	Giant Box Corer	ARK-VII/1	
PS1856-2	70.640	-14.452	670	Giant Box Corer	ARK-VII/1	
PS1857-1	70.480	-14.505	908	Giant Box Corer	ARK-VII/1	
PS1864-1	70.317	-8.653	458	Giant Box Corer	ARK-VII/1	
PS1873-1	72.300	-11.303	2109	Giant Box Corer	ARK-VII/1	
PS1874-1	72.490	-12.607	509	Giant Box Corer	ARK-VII/1	
PS1875-7	72.547	-12.255	2376	Giant Box Corer	ARK-VII/1	
PS1876-1	72.807	-12.773	2592	Giant Box Corer	ARK-VII/1	
PS1877-1	72.478	-13.067	2649	Giant Box Corer	ARK-VII/1	
PS1878-2	73.252	-9.015	3038	Giant Box Corer	ARK-VII/1	
PS1880-3	73.547	-9.080	333	Giant Box Corer	ARK-VII/1	
PS1882-1	73.592	-8.397	3169	Giant Box Corer	ARK-VII/1	
PS1886-3	73.538	-9.087	260	Giant Box Corer	ARK-VII/1	
PS1892-1	73.733	-9.625	3125	Giant Box Corer	ARK-VII/1	
PS1893-1	74.867	-10.110	3245	Giant Box Corer	ARK-VII/1	
PS1894-7	75.813	-8.258	1992	Giant Box Corer	ARK-VII/1	
PS1895-9	75.413	-7.310	3358	Giant Box Corer	ARK-VII/1	
PS1898-6	74.985	-4.965	3595	Giant Box Corer	ARK-VII/1	
PS1900-7	74.527	-2.335	3538	Giant Box Corer	ARK-VII/1	
PS1901-1	75.942	-3.733	3588	Giant Box Corer	ARK-VII/1	
PS1902-3	77.427	-5.765	4218	Giant Box Corer	ARK-VII/1	
PS1903-1	77.277	-5.022	1182	Giant Box Corer	ARK-VII/1	
PS1904-1	77.085	-3.988	1795	Giant Box Corer	ARK-VII/1	
PS1905-1	76.918	-3.383	1761	Giant Box Corer	ARK-VII/1	
PS1906-1	76.842	-2.150	2990	Giant Box Corer	ARK-VII/1	
PS1908-1	76.320	-1.072	2497	Giant Box Corer	ARK-VII/1	
PS1910-1	75.617	1.317	2448	Giant Box Corer	ARK-VII/1	
PS1911-1	75.050	2.967	2326	Giant Box Corer	ARK-VII/1	
PS1913-1	74.483	-5.407	2857	Giant Box Corer	ARK-VII/1	
PS1914-4	73.967	-7.663	1793	Giant Box Corer	ARK-VII/1	
PS1918-2	75.000	-12.408	1090	Giant Box Corer	ARK-VII/3	
PS1922-2	75.000	-8.772	3350	Giant Box Corer	ARK-VII/3	
PS1923-1	71.497	-20.498	256	Giant Box Corer	ARK-VII/3	

Table 1 (continued)

Station	Latitude [°N]	Longitude [°E]	Water Depth [m]	Gear	Expedition	Assigned Zone
PS1924-2	71.497	-19.178	279	Giant Box Corer	ARK-VII/3	
PS1926-2	71.497	-18.275	1495	Giant Box Corer	ARK-VII/3	
PS1927-1	71.497	-17.148	1735	Giant Box Corer	ARK-VII/3	
PS1928-1	70.353	-22.465	388	Giant Box Corer	ARK-VII/3	
PS1931-1	70.583	-24.325	279	Giant Box Corer	ARK-VII/3	
PS1935-1	70.475	-26.880	1262	Giant Box Corer	ARK-VII/3	
PS1939-1	71.538	-26.997	1234	Giant Box Corer	ARK-VII/3	
PS1943-1	70.117	-21.298	611	Giant Box Corer	ARK-VII/3	
PS1946-1	69.597	-22.340	320	Giant Box Corer	ARK-VII/3	
PS1947-2	69.275	-21.755	377	Giant Box Corer	ARK-VII/3	
PS1950-1	68.895	-20.935	1470	Giant Box Corer	ARK-VII/3	
PS2426-4	80.464	-13.630	314	Multicorer	ARK-IX/3	
PS2427-3	81.379	-6.845	250	Multicorer	ARK-IX/3	
PS2428-2	81.379	-6.845	2770	Multicorer	ARK-IX/3	
PS2429-4	81.345	-7.263	1723	Multicorer	ARK-IX/3	
PS2434-3	80.185	-16.265	209	Multicorer	ARK-IX/3	
PS2435-3	79.948	-15.034	162	Multicorer	ARK-IX/3	
PS2437-3	80.454	-13.647	320	Multicorer	ARK-IX/3	
PS2438-2	76.007	-5.005	3254	Multicorer	ARK-IX/3	
PS2613-1	74.177	-0.392	3257	Giant Box Corer	ARK-X/2	
PS2616-7	75.005	-7.203	3401	Giant Box Corer	ARK-X/2	MIZ
PS2618-1	75.098	-20.995	362	Giant Box Corer	ARK-X/2	CZ
PS2619-6			1761	Giant Box Corer	ARK-X/2	CZ
PS2620-1	75.192	-20.115	247	Giant Box Corer	ARK-X/2	CZ
PS2621-3	74.950	-19.290	410	Giant Box Corer	ARK-X/2	
PS2622-4			2448	Giant Box Corer	ARK-X/2	CZ
PS2623-1	74.858	-17.505	342	Giant Box Corer	ARK-X/2	CZ
PS2624-7	74.788	-17.630	329	Giant Box Corer	ARK-X/2	
PS2625-1			167	Giant Box Corer	ARK-X/2	
PS2626-5	73.173	-26.553	778	Giant Box Corer	ARK-X/2	
PS2627-5	73.123	-15.682	2009	Giant Box Corer	ARK-X/2	MIZ
PS2628-2	73.160	-15.967	1702	Giant Box Corer	ARK-X/2	MIZ
PS2629-2	73.158	-16.483	850	Giant Box Corer	ARK-X/2	MIZ
PS2630-7	73.160	-18.068	287	Giant Box Corer	ARK-X/2	ICZ
PS2631-2	73.178	-22.187	429	Giant Box Corer	ARK-X/2	CZ
PS2632-7	73.405	-23.647	505	Giant Box Corer	ARK-X/2	CZ
PS2633-1	73.482	-24.610	284	Giant Box Corer	ARK-X/2	CZ
PS2635-5	73.072	-25.048	451	Giant Box Corer	ARK-X/2	
PS2636-2	73.003	-24.703	332	Giant Box Corer	ARK-X/2	
PS2637-3	72.857	-24.593	338	Giant Box Corer	ARK-X/2	CZ
PS2638-6	72.087	-22.867	428	Giant Box Corer	ARK-X/2	CZ
PS2639-2				Giant Box Corer	ARK-X/2	
PS2640-3	73.073	-23.318	334	Giant Box Corer	ARK-X/2	CZ
PS2641-5	73.155	-19.485	469	Giant Box Corer	ARK-X/2	
PS2642-2	72.790	-25.822	759	Giant Box Corer	ARK-X/2	CZ
PS2643-5				Giant Box Corer	ARK-X/2	CZ
PS2645-5	68.395	-21.395	1001	Giant Box Corer	ARK-X/2	SOWZ
PS2646-2	68.558	-21.450	1115	Giant Box Corer	ARK-X/2	SOWZ
PS2647-5	68.775	-21.063	1375	Giant Box Corer	ARK-X/2	SOWZ
PS2648-3	70.525	-22.510	109	Giant Box Corer	ARK-X/2	CZ
PS2651-3	71.150	-25.542	773	Giant Box Corer	ARK-X/2	CZ
PS2654-6	70.922	-26.583	942	Giant Box Corer	ARK-X/2	CZ
PS2656-2	65.845	-4.067	3758	Giant Box Corer	ARK-X/2	SOWZ
PS37/008	78.933	-5.195	1098	Multicorer	ARK-XI/2	
PS37/012	78.975	-3.973	1961	Multicorer	ARK-XI/2	
PS37/014	78.990	-5.665	803	Multicorer	ARK-XI/2	
PS37/016	78.965	-7.688	183	Multicorer	ARK-XI/2	
PS37/021	80.022	-4.248	1854	Multicorer	ARK-XI/2	
PS37/022	79.570	-3.873	1957	Multicorer	ARK-XI/2	
PS37/025	74.965	-10.873	2851	Multicorer	ARK-XI/2	
PS37/026	74.922	-13.135	404	Multicorer	ARK-XI/2	
PS57/066	74.883	-13.028	655	Multicorer	ARK-XVI/1	ICZ
PS57/067	74.833	-12.858	1180	Multicorer	ARK-XVI/1	ICZ
PS57/068	74.783	-12.745	1565	Multicorer	ARK-XVI/1	

Table 1 (continued)

Station	Latitude [°N]	Longitude [°E]	Water Depth [m]	Gear	Expedition	Assigned Zone
PS57/069	74.712	-12.440	2124	Multicorer	ARK-XVI/1	ICZ
PS57/070	74.382	-10.278	3136	Multicorer	ARK-XVI/1	MIZ
PS57/072	74.415	-10.323	3204	Multicorer	ARK-XVI/1	
PS57/075	74.410	-9.847	3200	Multicorer	ARK-XVI/1	MIZ
PS57/076	74.455	-10.053	3215	Multicorer	ARK-XVI/1	MIZ
PS57/077	74.515	-10.382	3209	Multicorer	ARK-XVI/1	MIZ
PS57/078	74.457	-10.077	3240	Multicorer	ARK-XVI/1	
PS57/080	74.378	-10.343	3127	Multicorer	ARK-XVI/1	MIZ
PS57/082	74.405	-10.363	3209	Multicorer	ARK-XVI/1	MIZ
PS57/083	74.477	-10.807	3020	Multicorer	ARK-XVI/1	MIZ
PS57/084	74.373	-10.740	3172	Multicorer	ARK-XVI/1	MIZ
PS57/085			3192	Multicorer	ARK-XVI/1	MIZ
PS57/086	74.600	-11.413	3033	Multicorer	ARK-XVI/1	
PS57/087	74.627	-11.955	2572	Multicorer	ARK-XVI/1	MIZ
PS57/088	74.100	-13.047	2743	Multicorer	ARK-XVI/1	MIZ
PS57/090	74.130	-13.217	2644	Multicorer	ARK-XVI/1	MIZ
PS57/091	74.105	-13.263	2642	Multicorer	ARK-XVI/1	
PS57/092	74.093	-13.412	2494	Multicorer	ARK-XVI/1	MIZ
PS57/093	74.058	-13.007	2709	Multicorer	ARK-XVI/1	MIZ
PS57/094	74.057	-12.800	2833	Giant Box Corer	ARK-XVI/1	MIZ
PS57/095	74.085	-12.695	2866	Multicorer	ARK-XVI/1	MIZ
PS57/097	74.038	-12.248	2905	Multicorer	ARK-XVI/1	MIZ
PS57/098	74.122	-12.345	2790	Multicorer	ARK-XVI/1	MIZ
PS57/099	74.162	-12.363	2885	Multicorer	ARK-XVI/1	
PS57/100	74.187	-12.395	2932	Multicorer	ARK-XVI/1	MIZ
PS57/101	74.143	-12.352	2900	Multicorer	ARK-XVI/1	MIZ
PS57/102	74.055	-12.638	2747	Multicorer	ARK-XVI/1	MIZ
PS57/104	74.187	-11.437	3081	Giant Box Corer	ARK-XVI/1	MIZ
PS57/105	74.162	-11.333	2944	Multicorer	ARK-XVI/1	MIZ
PS59/064-1	74.119	-12.141	2882	Multicorer	ARK-XVII/1	MIZ
PS59/066-1	74.159	-12.100	2997	Multicorer	ARK-XVII/1	MIZ
PS59/068-1	74.185	-11.456	3077	Multicorer	ARK-XVII/1	MIZ
PS59/070-1	74.236	-11.557	3000	Multicorer	ARK-XVII/1	MIZ
PS59/072-1	74.499	-10.973	3132	Multicorer	ARK-XVII/1	MIZ
PS59/074-1	74.502	-10.973	3132	Giant Box Corer	ARK-XVII/1	MIZ
PS59/076-1	74.400	-10.266	3219	Multicorer	ARK-XVII/1	MIZ
PS59/077-2	74.362	-10.263	3138	Giant Box Corer	ARK-XVII/1	MIZ
PS59/079-1	74.419	-10.247	3208	Multicorer	ARK-XVII/1	MIZ
PS59/082-1	74.250	-9.568	3234	Multicorer	ARK-XVII/1	MIZ
PS59/084-1	74.761	-8.900	3320	Multicorer	ARK-XVII/1	MIZ
PS59/085-1	74.798	-8.964	3325	Multicorer	ARK-XVII/1	
PS59/086-2	74.779	-8.929	3395	Multicorer	ARK-XVII/1	MIZ
PS59/091-1	79.134	6.076	1284	Multicorer	ARK-XVII/1	
PS59/094-1	79.067	4.174	2468	Multicorer	ARK-XVII/1	
PS59/096-1	79.135	4.908	1524	Multicorer	ARK-XVII/1	
PS59/103-1	79.068	3.713	2916	Multicorer	ARK-XVII/1	
PS59/105-1	79.084	3.604	3348	Multicorer	ARK-XVII/1	
PS59/108-1	79.066	3.486	3997	Multicorer	ARK-XVII/1	
PS59/121-1	79.134	2.908	5576	Multicorer	ARK-XVII/1	
PS59/125-1	79.200	2.575	5416	Multicorer	ARK-XVII/1	
PS62/002-3	61.795	-39.374	1891	Giant Box Corer	ARK-XVIII/1	SOWZ
PS62/003-3	61.701	-39.068	2157	Giant Box Corer	ARK-XVIII/1	
PS62/004-2	61.526	-38.123	2564	Multicorer	ARK-XVIII/1	SOWZ
PS62/012-2	64.624	-31.693	2402	Giant Box Corer	ARK-XVIII/1	SOWZ
PS62/015-4	67.931	-25.429	980	Giant Box Corer	ARK-XVIII/1	SOWZ
PS62/017-1	67.851	-24.582	1458	Giant Box Corer	ARK-XVIII/1	SOWZ
PS62/020-1	70.999	-18.915	1322	Multicorer	ARK-XVIII/1	SOWZ
PS62/021-1	71.503	-16.837	1704	Multicorer	ARK-XVIII/1	SOWZ
PS62/022-3	72.491	-12.606	510	Giant Box Corer	ARK-XVIII/1	
PS62/026-3	74.332	-8.213	3341	Multicorer	ARK-XVIII/1	MIZ
PS62/027-1	74.824	-7.008	3455	Multicorer	ARK-XVIII/1	MIZ
PS62/028-1	74.849	-6.915	3428	Multicorer	ARK-XVIII/1	MIZ
PS62/029-2	74.799	-7.083	3399	Multicorer	ARK-XVIII/1	MIZ
PS62/029-3	74.796	-7.086	3400	Giant Box Corer	ARK-XVIII/1	

Table 1 (continued)

Station	Latitude [°N]	Longitude [°E]	Water Depth [m]	Gear	Expedition	Assigned Zone
PS62/035-1	74.833	-3.231	3624	Multicorer	ARK-XVIII/1	MIZ
PS62/038-1	74.767	-5.026	3530	Multicorer	ARK-XVIII/1	MIZ
PS62/041-1	74.684	-5.012	3527	Multicorer	ARK-XVIII/1	MIZ
PS62/044-1	74.790	-5.694	3558	Giant Box Corer	ARK-XVIII/1	MIZ
PS62/046-2	74.807	-8.146	3319	Giant Box Corer	ARK-XVIII/1	
PS62/046-3	74.808	-8.152	3318	Multicorer	ARK-XVIII/1	MIZ
PS62/048-1	74.841	-8.142	3373	Multicorer	ARK-XVIII/1	MIZ
PS62/050-1	74.867	-8.154	3313	Multicorer	ARK-XVIII/1	MIZ
PS62/054-1	74.435	-10.414	3102	Giant Box Corer	ARK-XVIII/1	
PS62/054-3	74.435	-10.414	3101	Multicorer	ARK-XVIII/1	MIZ
PS62/056-1	74.367	-10.380	3101	Multicorer	ARK-XVIII/1	MIZ
PS62/058-1	74.397	-10.395	3138	Multicorer	ARK-XVIII/1	MIZ
PS64/487-1	76.149	-17.283	236	Multicorer	ARK-XIX/4	CZ
PS64/488-1	76.183	-15.181	306	Multicorer	ARK-XIX/4	CZ
PS64/489-1	76.236	-11.002	302	Multicorer	ARK-XIX/4	ICZ
PS64/490-1	76.397	-9.991	253	Multicorer	ARK-XIX/4	ICZ
PS64/504-1	75.721	-8.090	2284	Multicorer	ARK-XIX/4	ICZ
PS64/506-1	75.853	-8.647	1700	Multicorer	ARK-XIX/4	ICZ
PS64/508-1	75.982	-9.197	1062	Multicorer	ARK-XIX/4	ICZ
PS64/511-1	76.166	-10.016	276	Multicorer	ARK-XIX/4	ICZ
PS64/516-1	76.475	-11.415	313	Multicorer	ARK-XIX/4	ICZ
PS64/526-1	75.464	-6.985	3374	Multicorer	ARK-XIX/4	MIZ
PS64/528-1	75.589	-7.577	3134	Multicorer	ARK-XIX/4	ICZ
PS64/529-1	75.645	-7.802	2958	Multicorer	ARK-XIX/4	ICZ
PS64/531-1	75.782	-8.347	1982	Multicorer	ARK-XIX/4	ICZ
PS64/573-1	74.832	-16.732	377	Multicorer	ARK-XIX/4	CZ
PS64/581-2	74.477	-14.439	259	Multicorer	ARK-XIX/4	ICZ
PS64/582-1	74.442	-14.195	561	Multicorer	ARK-XIX/4	ICZ
PS64/583-2	74.398	-13.894	1399	Multicorer	ARK-XIX/4	ICZ
PS64/584-1	74.369	-13.660	1850	Multicorer	ARK-XIX/4	
PS64/585-2	74.329	-13.393	2245	Multicorer	ARK-XIX/4	ICZ
PS64/586-1	74.301	-13.111	2492	Multicorer	ARK-XIX/4	ICZ
PS64/628-2	73.148	-12.611	2702	Multicorer	ARK-XIX/4	MIZ
PS64/706-1	72.710	-16.602	910	Multicorer	ARK-XIX/4	SOWZ
PS64/707-2	72.692	-16.477	1223	Multicorer	ARK-XIX/4	MIZ
PS64/708-1	72.677	-16.226	1600	Multicorer	ARK-XIX/4	MIZ
PS64/710-2	72.625	-15.671	1892	Multicorer	ARK-XIX/4	MIZ

Table 2 Position and expedition of onshore samples.

Station	Latitude [°N]	Longitude [°E]	Expedition
PS64 HELI 01-1	76.127	-18.602	ARK-XIX/4
PS64 HELI 01-2	76.114	-18.509	ARK-XIX/4
PS64 HELI 08-1	75.058	-18.764	ARK-XIX/4
PS64 HELI 09-1	74.976	-19.979	ARK-XIX/4
PS64 HELI 09-2	75.013	-20.101	ARK-XIX/4
PS64 HELI 09-4	75.192	-19.998	ARK-XIX/4
PS64 HELI 12-1	75.704	-19.602	ARK-XIX/4
PS64 HELI 12-2	75.622	-19.735	ARK-XIX/4
PS64 HELI 12-3	75.261	-20.905	ARK-XIX/4
PS64 HELI 13-1	74.138	-21.430	ARK-XIX/4
PS64 HELI 13-2	74.170	-22.326	ARK-XIX/4
PS64 HELI 13-3	73.950	-21.175	ARK-XIX/4
PS64 HELI 14-2	73.357	-23.818	ARK-XIX/4

Table 3 Position and expedition of sea-ice samples.

Station	Latitude [°N]	Longitude [°E]	Expedition
PS57 HELI 01-1	78.583	-4.767	ARK-XVI/2
PS62 HELI 01-1	75.123	-16.528	ARK-XVIII/1
PS62 HELI 02-1	75.009	-13.641	ARK-XVIII/1
PS62 HELI 03-1	79.200	2.672	ARK-XVIII/1
PS62 HELI 04-1	79.150	3.027	ARK-XVIII/1
PS62 HELI 05-1	78.990	-0.004	ARK-XVIII/1
PS62 HELI 05-2	78.967	0.655	ARK-XVIII/1
PS62 HELI 06-1	79.034	-2.039	ARK-XVIII/1
PS62 HELI 06-2	78.782	-2.002	ARK-XVIII/1
PS62 HELI 07-1	78.943	-4.600	ARK-XVIII/1
PS62 HELI 07-2	78.923	-4.930	ARK-XVIII/1
PS62 HELI 08-1	78.756	-7.113	ARK-XVIII/1
PS62 HELI 08-2	78.756	-7.113	ARK-XVIII/1
PS62 HELI 08-3	78.756	-7.113	ARK-XVIII/1
PS62 HELI 09-1	78.909	-14.648	ARK-XVIII/1
PS62 HELI 10-1	78.844	-17.657	ARK-XVIII/1
PS64 HELI 02-1	76.383	-4.639	ARK-XIX/4
PS64 HELI 02-2	76.380	-4.654	ARK-XIX/4
PS64 HELI 03-1	76.918	-6.529	ARK-XIX/4
PS64 HELI 04-1	76.750	-5.480	ARK-XIX/4
PS64 HELI 04-2	76.747	-5.459	ARK-XIX/4
PS64 HELI 05-1	77.150	-1.172	ARK-XIX/4
PS64 HELI 06-1	77.150	-1.201	ARK-XIX/4
PS64 HELI 07-1	75.586	-8.048	ARK-XIX/4
PS64 HELI 10-2	75.698	-8.930	ARK-XIX/4
PS64 HELI 11-1	76.115	-8.745	ARK-XIX/4
PS64 HELI 11-2	76.217	-8.245	ARK-XIX/4
PS64 HELI 11-3	76.216	-8.999	ARK-XIX/4

Table 4 Position, water depth, gear and expedition of core samples.

Station	Latitude [°N]	Longitude [°E]	Water Depth [m]	Gear	Expedition
PS2644-5	67.867	-21.765	777	Gravity Corer	ARK-X/2
PS62/003-2	61.701	-39.068	2157	Piston Corer	ARK-XVIII/1
PS62/004-3	61.526	-38.123	2564	Piston Corer	ARK-XVIII/1
PS62/015-3	67.931	-25.429	980	Piston Corer	ARK-XVIII/1
PS62/017-2	67.851	-24.582	1458	Piston Corer	ARK-XVIII/1

Table 5 Results of elemental analysis of marine surface samples.

Station	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
GIK23424-3	5.23	0.13	0.91	36	7
GIK23453-1	2.70	0.05	0.43	19	9
GIK23455-2	3.84	0.10	0.57	27	6
GIK23456-6	3.64	0.13	0.82	23	6
GIK23457-3	5.84	0.10	0.62	43	6
GIK23458-3	5.59	0.10	0.73	40	7
GIK23459-2	3.69	0.07	0.38	28	5
GIK23477-1	3.46	0.07	0.44	25	6
GIK23481-2	1.10	0.16	0.83	2	5
GIK23482-2	0.88	0.09	0.57	3	6
GIK23483-2	2.29	0.24	1.39	7	6
GIK23484-2	1.36	0.19	1.12	2	6
GIK23486-3	1.03	0.13	0.78	2	6
GIK23487-2	0.90	0.10	0.59	3	6
GIK23488-1	7.53	0.10	0.57	58	6
GIK23489-2	5.84	0.08	0.53	44	7
GIK23548-8	3.79	0.10	0.63	26	6
GIK23552-8	0.85	0.10	0.62	2	6
GIK23553-8	0.91	0.12	0.65	2	5
PS1697-1	2.70	0.14	0.43	19	3
PS1698-2	3.84	0.10	0.57	27	6
PS1703-1	3.64	0.13	0.82	23	6
PS1706-1	5.84	0.10	0.62	43	6
PS1707-1	5.59	0.10	0.73	40	7
PS1737-2	3.69	0.07	0.38	28	5
PS1743-2	3.46	0.07	0.44	25	6
PS1842-5	1.10	0.16	0.83	2	5
PS1843-2	0.88	0.09	0.57	3	6
PS1845-2	2.30	0.10	0.60	14	6
PS1846-3	2.29	0.24	1.39	7	6
PS1852-1	1.50	0.10	0.80	6	8
PS1855-1	1.36	0.19	1.12	2	6
PS1856-2	1.03	0.13	0.78	2	6
PS1857-1	0.90	0.10	0.59	3	6
PS1864-1	1.50	0.00	0.30	10	n.d.
PS1873-1	2.00	0.10	0.90	9	9
PS1874-1	7.53	0.10	0.57	58	6
PS1875-7	1.60	0.10	0.50	9	5
PS1876-1	2.10	0.10	0.80	11	8
PS1877-1	2.00	0.10	0.70	11	7
PS1878-2	5.84	0.08	0.53	44	7
PS1880-3	3.79	0.10	0.63	26	6
PS1882-1	2.50	0.10	0.70	15	7
PS1886-3	0.85	0.10	0.62	2	6
PS1892-1	0.91	0.12	0.65	2	5
PS1893-1	2.80	0.10	0.50	19	5
PS1894-7	2.31	0.14	0.79	13	6
PS1895-9	0.83	0.11	0.48	3	4
PS1898-6	3.00	0.10	0.70	19	7
PS1900-7	2.60	0.10	0.80	15	8
PS1901-1	3.90	0.10	0.50	28	5
PS1902-3	0.43	0.06	0.20	2	3
PS1903-1	1.20	0.10	0.40	7	4
PS1904-1	3.45	0.13	0.76	22	6
PS1905-1	2.05	0.16	0.87	10	5
PS1906-1	1.31	0.11	0.55	6	5
PS1908-1	1.73	0.14	0.51	10	4
PS1910-1	1.82	0.15	0.75	9	5
PS1911-1	2.17	0.13	0.62	13	5
PS1913-1	2.35	0.12	0.61	14	5
PS1914-4	2.14	0.15	0.67	12	4
PS1918-2	1.20	0.10	0.50	6	5
PS1922-2	3.20	0.10	0.50	22	5
PS1923-1	0.90	0.10	0.90	0	9

Table 5 (continued)

Station	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
PS1924-2	0.80	0.10	0.70	1	7
PS1926-2	1.00	0.10	0.70	2	7
PS1927-1	1.40	0.10	0.80	5	8
PS1928-1	0.90	0.10	0.90	0	9
PS1931-1	0.80	n.d.	0.80	0	n.d.
PS1935-1	0.10	n.d.	0.10	0	n.d.
PS1939-1	0.80	n.d.	0.30	4	n.d.
PS1943-1	1.00	0.10	1.10	0	11
PS1946-1	0.40	n.d.	0.30	1	n.d.
PS1947-2	0.40	n.d.	0.50	0	n.d.
PS1950-1	0.80	0.10	0.70	1	7
PS2426-4	3.78	0.16	0.82	25	5
PS2427-3	1.49	0.13	0.54	8	4
PS2428-2	2.56	0.11	0.56	17	5
PS2429-4	2.72	0.16	1.00	14	6
PS2434-3	2.10	0.04	0.38	14	10
PS2435-3	7.31	0.08	0.38	58	5
PS2437-3	3.06	0.15	0.87	18	6
PS2438-2	1.65	0.10	0.48	10	5
PS2613-1	3.39	0.13	0.91	21	7
PS2616-7	3.55	0.10	0.69	24	7
PS2618-1	0.63	0.06	0.56	1	10
PS2619-6	1.52	0.10	0.54	8	5
PS2620-1	1.06	0.08	0.81	2	10
PS2621-3	1.37	0.13	1.21	1	9
PS2622-4	3.82	0.13	0.71	26	5
PS2623-1	1.13	0.12	1.02	1	9
PS2624-7	0.96	0.10	0.83	1	8
PS2625-1	4.46	0.07	0.35	34	5
PS2626-5	0.33	0.02	0.15	2	9
PS2627-5	1.67	0.09	0.69	8	7
PS2628-2	1.43	0.09	0.64	7	7
PS2629-2	1.51	0.12	0.70	7	6
PS2630-7	0.44	0.04	0.32	1	7
PS2631-2	1.02	0.08	0.61	3	8
PS2632-7	0.88	0.02	0.25	5	14
PS2633-1	0.54	0.02	0.18	3	10
PS2635-5	1.94	0.06	0.47	12	8
PS2636-2	1.12	0.05	0.38	6	8
PS2637-3	1.02	0.05	0.38	5	8
PS2638-6	1.15	0.12	0.91	2	7
PS2639-2	n.d.	n.d.	0.32	n.d.	n.d.
PS2640-3	0.72	0.04	0.32	3	9
PS2641-5	1.20	0.13	0.93	2	7
PS2642-2	0.19	0.01	0.10	1	12
PS2643-5	n.d.	n.d.	0.09	n.d.	n.d.
PS2645-5	1.12	0.14	0.93	2	7
PS2646-2	0.96	0.11	0.76	2	7
PS2647-5	0.88	0.10	0.65	2	7
PS2648-3	0.86	0.06	0.69	1	12
PS2651-3	0.20	0.01	0.14	0	12
PS2654-6	0.42	0.01	0.13	2	13
PS2656-2	6.31	0.09	0.63	47	7
PS37/008	1.06	0.12	0.54	4	5
PS37/012	1.62	0.07	0.46	10	7
PS37/014	0.89	0.11	0.55	3	5
PS37/016	0.50	0.06	0.36	1	6
PS37/021	1.19	0.03	0.17	8	6
PS37/022	1.04	0.08	0.39	5	5
PS37/025	3.39	0.06	0.37	25	6
PS37/026	0.51	0.05	0.32	2	6
PS57/066	1.13	0.07	0.48	5	7
PS57/067	1.39	0.07	0.48	8	7
PS57/068	1.62	0.07	0.56	9	8

Table 5 (continued)

Station	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
PS57/069	1.66	0.06	0.45	10	7
PS57/070	2.81	0.11	0.82	17	7
PS57/072	2.68	0.11	0.79	16	7
PS57/075	2.73	0.11	0.76	16	7
PS57/076	1.97	0.09	0.61	11	7
PS57/077	2.51	0.10	0.73	15	7
PS57/078	2.47	0.10	0.75	14	8
PS57/080	2.71	0.12	0.83	16	7
PS57/082	2.63	0.11	0.80	15	7
PS57/083	2.59	0.10	0.75	15	7
PS57/084	2.59	0.12	0.86	14	7
PS57/085	n.d.	n.d.	0.83	n.d.	n.d.
PS57/086	3.10	0.07	0.55	21	7
PS57/087	3.08	0.06	0.48	22	8
PS57/088	2.34	0.08	0.58	15	7
PS57/090	2.15	0.08	0.58	13	7
PS57/091	2.02	0.09	0.65	11	8
PS57/092	2.01	0.09	0.64	11	7
PS57/093	2.14	0.10	0.73	12	7
PS57/094	2.22	0.10	0.76	12	7
PS57/095	2.15	0.09	0.70	12	8
PS57/097	1.88	0.09	0.63	10	7
PS57/098	2.26	0.09	0.67	13	7
PS57/099	2.25	0.10	0.74	13	7
PS57/100	2.23	0.10	0.74	12	8
PS57/101	2.28	0.11	0.77	13	7
PS57/102	2.23	0.10	0.72	13	7
PS57/104	2.17	0.10	0.72	12	7
PS57/105	2.41	0.11	0.79	13	7
PS59/064-1	2.35	0.10	0.76	13	7
PS59/066-1	2.24	0.11	0.73	13	7
PS59/068-1	2.46	0.10	0.73	14	7
PS59/070-1	2.61	0.11	0.77	15	7
PS59/072-1	2.43	0.10	0.66	15	7
PS59/074-1	2.69	0.11	0.78	16	7
PS59/076-1	2.84	0.10	0.81	17	8
PS59/077-2	3.09	0.13	0.84	19	7
PS59/079-1	2.58	0.09	0.66	16	7
PS59/082-1	3.08	0.11	0.67	20	6
PS59/084-1	2.83	0.11	0.84	17	7
PS59/085-1	3.24	0.10	0.68	21	7
PS59/086-2	2.78	0.10	0.72	17	7
PS59/091-1	3.00	0.19	1.43	13	8
PS59/094-1	1.82	0.11	0.78	9	7
PS59/096-1	3.17	0.18	1.36	15	7
PS59/103-1	1.84	0.12	0.95	7	8
PS59/105-1	1.69	0.11	0.93	6	8
PS59/108-1	0.83	0.07	0.75	1	10
PS59/121-1	1.86	0.18	1.56	3	8
PS59/125-1	1.72	0.16	1.32	3	8
PS62/002-3	2.20	0.03	0.20	17	7
PS62/003-3	2.32	0.03	0.23	17	7
PS62/004-2	3.24	0.05	0.37	24	7
PS62/012-2	2.75	0.03	0.23	21	8
PS62/015-4	0.75	0.09	0.59	1	7
PS62/017-1	0.75	0.09	0.62	1	7
PS62/020-1	0.99	0.10	0.64	3	7
PS62/021-1	1.70	0.12	0.79	8	7
PS62/022-3	2.99	0.10	0.71	19	7
PS62/026-3	2.98	0.12	0.87	18	7
PS62/027-1	3.12	0.11	0.77	20	7
PS62/028-1	3.56	0.10	0.69	24	7
PS62/029-2	3.40	0.09	0.64	23	7
PS62/029-3	3.38	0.10	0.74	22	7

Table 5 (continued)

Station	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
PS62/035-1	0.83	0.09	0.59	2	7
PS62/038-1	0.91	0.04	0.28	5	7
PS62/041-1	3.58	0.09	0.67	24	7
PS62/044-1	2.97	0.11	0.78	18	7
PS62/046-2	3.22	0.10	0.72	21	7
PS62/046-3	3.42	0.10	0.75	22	8
PS62/048-1	3.09	0.10	0.75	19	8
PS62/050-1	3.19	0.09	0.70	21	7
PS62/054-1	2.82	0.12	0.85	16	7
PS62/054-3	2.69	0.11	0.81	16	7
PS62/056-1	2.75	0.12	0.85	16	7
PS62/058-1	2.60	0.11	0.85	15	7
PS64/487-1	0.57	0.07	0.53	0	8
PS64/488-1	1.05	0.13	0.88	1	7
PS64/489-1	0.64	0.07	0.44	2	7
PS64/490-1	0.52	0.04	0.27	2	7
PS64/504-1	2.86	0.05	0.39	21	8
PS64/506-1	1.75	0.07	0.50	10	7
PS64/508-1	1.29	0.05	0.40	7	7
PS64/511-1	0.76	0.07	0.44	3	6
PS64/516-1	0.81	0.09	0.62	2	7
PS64/526-1	3.23	0.08	0.61	22	7
PS64/528-1	3.91	0.07	0.58	28	8
PS64/529-1	4.00	0.07	0.50	29	7
PS64/531-1	1.81	0.07	0.54	11	7
PS64/573-1	1.14	0.13	1.02	1	8
PS64/581-2	0.53	0.06	0.37	1	7
PS64/582-1	0.95	0.06	0.44	4	8
PS64/583-2	1.18	0.06	0.51	6	8
PS64/584-1	1.44	0.06	0.44	8	7
PS64/585-2	1.84	0.08	0.53	11	7
PS64/586-1	1.98	0.08	0.58	12	7
PS64/628-2	2.40	0.13	0.92	12	7
PS64/706-1	0.91	0.06	0.42	4	7
PS64/707-2	0.91	0.07	0.51	3	7
PS64/708-1	1.27	0.09	0.68	5	8
PS64/710-2	1.96	0.11	0.80	10	7

Table 6 Results of elemental analysis of onshore samples.

Station	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
PS64 HELI 01-1	0.28	0.02	0.29	0	15
PS64 HELI 01-2	1.05	0.06	0.80	2	13
PS64 HELI 08-1	0.19	0.01	0.18	0	12
PS64 HELI 09-1	0.82	0.05	0.95	0	18
PS64 HELI 09-2	0.08	0.01	0.08	0	8
PS64 HELI 09-4	2.00	n.d.	0.09	16	n.d.
PS64 HELI 12-1	0.22	0.02	0.21	0	14
PS64 HELI 12-2	0.95	0.05	0.89	0	17
PS64 HELI 12-3	0.33	0.03	0.28	0	10
PS64 HELI 13-1	0.23	0.01	0.15	1	14
PS64 HELI 13-2	0.63	n.d.	0.03	5	n.d.
PS64 HELI 13-3	0.66	0.02	0.22	4	13
PS64 HELI 14-2	0.40	0.01	0.10	2	12

Table 7 Results of elemental analysis of sea-ice samples.

Station	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
PS57 HELI 01-1	1.98	0.25	1.69	2	7
PS62 HELI 01-1	1.59	0.07	0.86	6	13
PS62 HELI 02-1	2.05	0.19	1.65	3	9
PS62 HELI 03-1	1.30	0.13	1.19	1	9
PS62 HELI 04-1	3.24	0.32	2.77	4	9
PS62 HELI 05-1	1.36	0.13	1.16	2	9
PS62 HELI 05-2	1.48	0.16	1.25	2	8
PS62 HELI 06-1	2.90	0.28	2.53	3	9
PS62 HELI 06-2	1.50	0.18	1.17	3	7
PS62 HELI 07-1	1.17	0.09	1.06	1	11
PS62 HELI 07-2	1.96	0.15	1.81	1	12
PS62 HELI 08-1	1.80	0.18	1.45	3	8
PS62 HELI 08-2	1.62	0.15	1.39	2	9
PS62 HELI 08-3	1.69	0.17	1.42	2	8
PS62 HELI 09-1	1.77	0.21	1.48	2	7
PS62 HELI 10-1	1.10	0.11	0.98	1	9
PS64 HELI 02-1	2.05	0.17	1.86	2	11
PS64 HELI 02-2	0.97	0.09	0.9	1	10
PS64 HELI 03-1	1.80	0.16	1.49	3	10
PS64 HELI 04-1	1.37	0.12	1.08	2	9
PS64 HELI 04-2	1.56	0.13	1.16	3	9
PS64 HELI 05-1	1.26	0.13	1.14	1	9
PS64 HELI 06-1	n.d.	n.d.	1.41	n.d.	n.d.
PS64 HELI 07-1	1.42	0.14	1.22	2	9
PS64 HELI 10-2	1.52	0.13	1.27	2	9
PS64 HELI 11-1	1.72	0.19	1.44	2	8
PS64 HELI 11-2	1.20	0.14	1.08	1	8
PS64 HELI 11-3	1.08	0.10	0.79	2	8

Table 8 Results of Rock-Eval Pyrolysis of marine surface samples.

Station	S1 [mg HC/g Sed]	S2 [mg HC/g Sed]	S3 [mg CO_2/g Sed]	T_{max} [°C]	HI [mg HC/g TOC]	HI(S1+S2)' [mg HC/g TOC]	OI [mg CO_2/g TOC]
GIK23424-3	0.19	0.95	7.59	416	104	125	834
GIK23453-1	0.05	0.24	1.95	425	56	67	453
GIK23455-2	0.08	0.39	3.07	407	68	82	539
GIK23456-6	0.15	0.74	4.42	425	90	109	539
GIK23457-3	0.11	0.50	3.56	422	81	98	574
GIK23458-3	0.14	0.66	4.73	417	90	110	648
GIK23459-2	0.06	0.24	2.42	423	63	79	637
GIK23477-1	0.09	0.31	2.47	349	70	91	561
GIK23481-2	0.17	0.69	3.74	415	83	104	451
GIK23482-2	0.13	0.44	2.67	346	77	100	468
GIK23483-2	0.35	1.88	4.75	405	135	160	342
GIK23484-2	0.27	1.08	4.63	413	96	121	413
GIK23486-3	0.20	0.77	3.22	408	99	124	413
GIK23487-2	0.15	0.44	3.23	339	75	100	547
GIK23488-1	0.13	0.50	3.80	356	88	111	667
GIK23489-2	0.14	0.44	3.94	348	83	109	743
GIK23548-8	0.10	0.41	3.64	372	65	81	578
GIK23552-8	0.11	0.42	2.25	349	68	85	363
GIK23553-8	0.13	0.48	2.43	359	74	94	374
PS1697-1	0.05	0.24	1.95	425	56	67	453
PS1698-2	0.08	0.39	3.07	407	68	82	539
PS1703-1	0.15	0.74	4.42	425	90	109	539
PS1706-1	0.11	0.50	3.56	422	81	98	574
PS1707-1	0.14	0.66	4.73	417	90	110	648
PS1737-2	0.09	0.32	2.30	418	84	108	605
PS1743-2	0.08	0.31	2.49	421	70	89	566
PS1842-5	0.17	0.69	3.74	415	83	104	451
PS1843-2	0.13	0.44	2.67	346	77	100	468
PS1846-3	0.35	1.88	4.75	405	135	160	342
PS1855-1	0.27	1.08	4.63	413	96	121	413
PS1856-2	0.20	0.77	3.22	408	99	124	413
PS1857-1	0.12	0.44	3.01	342	75	95	510
PS1874-1	0.13	0.50	3.80	356	88	111	667
PS1878-2	0.18	0.76	4.51	421	143	177	851
PS1880-3	0.08	0.27	1.58	403	43	56	251
PS1886-3	0.09	0.38	2.50	402	61	76	403
PS1892-1	0.15	0.67	3.93	424	103	126	605
PS1894-7	0.08	0.37	1.99	418	47	57	252
PS1895-9	0.11	0.49	2.59	411	102	125	540

Table 8 (continued)

Station	S1 [mg HC/g Sed]	S2 [mg HC/g Sed]	S3 [mg CO_2/g Sed]	T_{max} [°C]	HI [mg HC/g TOC]	HI(S1+S2)' [mg HC/g TOC]	OI [mg CO_2/g TOC]
PS1902-3	0.07	0.25	1.47	343	125	160	735
PS1904-1	0.12	0.50	4.02	425	66	82	529
PS1905-1	0.14	0.57	4.16	427	66	82	478
PS1906-1	0.08	0.31	2.64	418	56	71	480
PS1908-1	0.08	0.31	2.73	418	61	76	535
PS1910-1	0.15	0.54	4.04	350	72	92	539
PS1911-1	0.12	0.45	3.66	360	73	92	590
PS1913-1	0.12	0.45	4.25	422	74	93	697
PS1914-4	0.07	0.31	2.16	401	46	57	322
PS2426-4	0.17	0.72	4.39	417	88	109	535
PS2427-3	0.12	0.43	3.15	425	80	102	583
PS2428-2	0.10	0.38	3.60	409	68	86	643
PS2429-4	0.16	0.73	5.06	425	73	89	506
PS2434-3	0.08	0.29	1.85	404	76	97	487
PS2435-3	0.08	0.36	2.84	403	95	116	747
PS2437-3	0.15	0.64	4.55	425	74	91	523
PS2438-2	0.14	0.50	2.45	414	104	133	510
PS2613-1	0.18	0.77	4.75	418	85	104	522
PS2616-7	0.13	0.58	3.18	415	84	103	460
PS2618-1	0.11	0.50	1.48	407	89	108	262
PS2619-6	0.10	0.45	1.74	413	83	102	322
PS2620-1	0.12	0.63	1.83	416	77	92	225
PS2621-3	0.13	0.86	3.09	417	71	82	255
PS2622-4	0.13	0.61	4.27	423	86	104	601
PS2623-1	0.14	0.72	2.62	413	70	84	256
PS2624-7	0.12	0.66	2.05	414	80	94	248
PS2625-1	0.07	0.30	2.42	408	86	106	691
PS2626-5	0.03	0.17	0.63	n.d.	114	135	424
PS2627-5	0.13	0.50	3.13	419	73	92	455
PS2628-2	0.11	0.43	2.71	420	68	85	427
PS2629-2	0.14	0.57	2.60	400	81	101	369
PS2630-7	0.06	0.30	0.74	363	93	111	228
PS2631-2	0.10	0.44	1.98	417	72	89	325
PS2632-7	0.02	0.09	1.57	426	36	44	622
PS2633-1	0.03	0.11	0.62	340	61	78	346
PS2635-5	0.09	0.33	1.76	411	70	89	371
PS2636-2	0.08	0.29	1.34	362	76	97	351
PS2637-3	0.08	0.27	1.44	343	70	91	374
PS2638-6	0.18	0.72	2.93	356	79	99	323

Table 8 (continued)

Station	S1 [mg HC/g Sed]	S2 [mg HC/g Sed]	S3 [mg CO_2/g Sed]	T_{max} [°C]	HI [mg HC/g TOC]	HI(S1+S2)' [mg HC/g TOC]	OI [mg CO_2/g TOC]
PS2640-3	0.05	0.31	1.25	386	96	112	389
PS2641-5	0.18	0.77	2.70	358	83	102	290
PS2642-2	0.02	0.15	0.31	n.d.	157	178	324
PS2645-5	0.19	0.82	3.05	356	88	109	328
PS2646-2	0.15	0.64	2.43	355	84	104	320
PS2647-5	0.12	0.53	2.28	340	82	101	353
PS2648-3	0.08	0.63	1.39	417	91	103	201
PS2651-3	0.03	0.24	0.38	n.d.	168	189	266
PS2654-6	0.02	0.12	0.68	n.d.	95	111	541
PS2656-2	0.15	0.75	4.60	403	120	143	733
PS37/008	0.09	0.34	2.50	343	63	80	463
PS37/012	0.07	0.27	2.50	421	59	74	543
PS37/014	0.10	0.41	2.08	348	75	93	378
PS37/016	0.06	0.27	1.00	353	75	92	278
PS37/021	0.02	0.08	0.93	349	47	59	547
PS37/022	0.05	0.18	1.80	346	46	59	462
PS37/025	0.06	0.20	1.94	441	54	70	524
PS37/026	0.06	0.24	1.17	343	75	94	366
PS57/066	0.09	0.34	1.98	341	71	90	415
PS57/067	0.09	0.31	2.36	338	65	83	492
PS57/068	0.09	0.35	2.35	344	63	79	420
PS57/069	0.08	0.34	1.88	415	75	93	417
PS57/070	0.15	0.72	3.89	418	87	105	472
PS57/072	0.13	0.60	3.56	421	76	93	452
PS57/075	0.13	0.52	3.60	416	69	86	477
PS57/076	0.12	0.50	3.37	418	83	102	556
PS57/077	0.13	0.56	3.90	417	77	95	536
PS57/078	0.14	0.61	3.65	418	81	100	485
PS57/080	0.15	0.66	3.90	418	79	97	468
PS57/082	0.15	0.63	3.68	419	79	98	460
PS57/083	0.14	0.61	3.82	418	82	100	511
PS57/084	0.16	0.72	3.76	419	84	103	439
PS57/086	0.10	0.46	2.79	418	84	102	509
PS57/087	0.08	0.36	2.19	418	74	91	453
PS57/088	0.11	0.44	2.71	415	76	95	467
PS57/090	0.10	0.44	2.90	419	75	92	497
PS57/091	0.12	0.51	2.98	417	79	97	459
PS57/092	0.11	0.45	2.95	422	71	88	463
PS57/093	0.13	0.59	3.23	419	81	99	445

Table 8 (continued)

Station	S1 [mg HC/g Sed]	S2 [mg HC/g Sed]	S3 [mg CO_2/g Sed]	T_{max} [°C]	HI [mg HC/g TOC]	HI(S1+S2)' [mg HC/g TOC]	OI [mg CO_2/g TOC]
PS57/094	0.13	0.52	3.42	422	69	86	452
PS57/095	0.12	0.52	3.14	420	75	92	451
PS57/097	0.12	0.56	2.90	417	89	108	460
PS57/098	0.13	0.53	3.51	419	79	98	520
PS57/099	0.13	0.57	3.52	419	77	95	477
PS57/100	0.13	0.55	3.43	421	74	92	463
PS57/101	0.15	0.61	3.93	419	79	98	507
PS57/102	0.13	0.55	3.21	420	77	95	448
PS57/104	0.12	0.49	3.58	416	68	85	499
PS57/105	0.14	0.58	3.47	421	73	91	439
PS59/064-1	0.12	0.59	3.82	420	78	93	503
PS59/066-1	0.12	0.53	3.87	420	73	89	531
PS59/068-1	0.13	0.56	3.64	420	77	94	498
PS59/070-1	0.14	0.64	4.43	423	83	101	572
PS59/072-1	0.12	0.56	3.82	425	84	102	575
PS59/074-1	0.14	0.67	4.35	424	86	103	556
PS59/076-1	0.15	0.68	3.95	423	84	102	487
PS59/077-2	0.16	0.77	4.12	426	92	111	490
PS59/079-1	0.12	0.51	3.39	422	77	95	510
PS59/082-1	0.15	0.70	3.93	422	104	127	587
PS59/084-1	0.15	0.68	3.75	419	81	99	448
PS59/085-1	0.14	0.67	3.53	426	99	119	519
PS59/086-2	0.12	0.58	3.86	425	81	98	538
PS59/091-1	0.24	1.70	5.44	426	119	136	381
PS59/094-1	0.13	0.70	3.29	428	90	107	423
PS59/096-1	0.24	1.77	5.74	425	131	148	423
PS59/103-1	0.13	0.91	3.32	428	96	110	350
PS59/105-1	0.12	0.94	3.10	429	101	114	333
PS59/108-1	0.04	0.53	1.08	428	70	76	143
PS59/121-1	0.23	1.37	3.56	415	88	103	228
PS59/125-1	0.17	1.24	3.38	423	94	107	257
PS62/002-3	0.04	0.15	1.47	371	76	97	750
PS62/003-3	0.05	0.26	1.94	428	113	135	843
PS62/004-2	0.08	0.32	2.38	375	86	107	637
PS62/012-2	0.04	0.14	2.32	341	62	80	1026
PS62/015-4	0.12	0.58	1.89	369	99	119	322
PS62/017-1	0.11	0.54	2.00	370	87	105	323
PS62/020-1	0.13	0.49	2.29	342	77	97	358
PS62/021-1	0.14	0.53	3.37	342	67	85	426

Table 8 (continued)

Station	S1 [mg HC/g Sed]	S2 [mg HC/g Sed]	S3 [mg CO_2/g Sed]	T_{max} [°C]	HI [mg HC/g TOC]	HI(S1+S2)' [mg HC/g TOC]	OI [mg CO_2/g TOC]
PS62/022-3	0.12	0.57	3.24	412	80	97	454
PS62/026-3	0.17	0.71	3.48	417	81	101	399
PS62/027-1	0.15	0.63	3.38	414	82	101	438
PS62/028-1	0.13	0.57	3.08	417	83	102	447
PS62/029-2	0.12	0.48	2.96	364	74	93	459
PS62/029-3	0.14	0.62	3.26	417	84	103	441
PS62/035-1	0.10	0.47	2.56	419	79	96	431
PS62/038-1	0.05	0.22	1.12	417	79	96	400
PS62/041-1	0.12	0.56	3.25	415	84	102	489
PS62/044-1	0.14	0.66	3.28	418	85	103	421
PS62/046-2	0.14	0.59	3.14	411	82	102	438
PS62/046-3	0.14	0.64	3.28	415	85	103	435
PS62/048-1	0.14	0.60	3.57	418	80	98	473
PS62/050-1	0.13	0.55	3.59	415	79	98	516
PS62/054-1	0.16	0.67	3.47	416	79	98	409
PS62/054-3	0.15	0.63	3.72	413	78	96	460
PS62/056-1	0.16	0.67	3.67	420	79	98	432
PS62/058-1	0.15	0.65	3.54	417	77	95	418
PS64/487-1	0.07	0.40	1.26	407	76	89	239
PS64/488-1	0.18	0.72	3.02	351	82	103	344
PS64/489-1	0.10	0.37	1.37	341	84	107	312
PS64/490-1	0.08	0.27	0.84	348	99	129	308
PS64/506-1	0.09	0.38	2.10	415	76	94	421
PS64/508-1	0.07	0.26	1.71	348	65	83	428
PS64/511-1	0.11	0.40	1.53	340	91	116	349
PS64/516-1	0.14	0.53	1.84	339	86	109	299
PS64/526-1	0.10	0.48	3.70	417	79	95	606
PS64/528-1	0.11	0.51	3.11	417	87	106	533
PS64/529-1	0.10	0.45	2.82	411	89	109	560
PS64/531-1	0.10	0.43	2.55	418	80	99	476
PS64/573-1	0.17	0.76	2.80	404	75	91	275
PS64/581-2	0.09	0.38	1.14	356	101	125	304
PS64/582-1	0.08	0.34	1.88	360	77	95	423
PS64/584-1	0.08	0.34	1.94	418	77	95	440
PS64/585-2	0.10	0.46	2.74	420	86	105	514
PS64/586-1	0.12	0.47	2.77	420	80	101	474
PS64/628-2	0.18	0.69	4.66	417	75	94	505
PS64/706-1	0.08	0.29	1.84	343	70	89	443
PS64/707-2	0.10	0.37	1.93	344	72	92	377

Table 8 (continued)

Station	S1 [mg HC/g Sed]	S2 [mg HC/g Sed]	S3 [mg CO_2/g Sed]	T_{max} [°C]	HI [mg HC/g TOC]	HI(S1+S2)' [mg HC/g TOC]	OI [mg CO_2/g TOC]
PS64/708-1	0.11	0.42	2.67	422	62	78	394
PS64/710-2	0.14	0.53	3.82	416	66	83	475

Table 9 Results of Rock-Eval Pyrolysis of onshore samples.

Station	S1 [mg HC/g Sed]	S2 [mg HC/g Sed]	S3 [mg CO_2/g Sed]	T_{max} [°C]	HI [mg HC/g TOC]	HI(S1+S2)' [mg HC/g TOC]	OI [mg CO_2/g TOC]
PS64 HELI 01-1	0.02	0.21	0.57	414	71	115	193
PS64 HELI 01-2	0.35	2.08	2.11	414	259	343	263
PS64 HELI 08-1	0.02	0.18	0.66	393	102	246	375
PS64 HELI 09-1	0.71	1.56	1.20	291	165	267	127
PS64 HELI 09-2	0.01	0.08	0.33	365	98	-672	404
PS64 HELI 09-4	0.01	0.09	0.25	425	105	-1042	293
PS64 HELI 12-1	0.03	0.26	0.49	404	122	244	229
PS64 HELI 12-2	0.68	1.75	1.30	418	197	306	146
PS64 HELI 12-3	0.09	0.46	0.62	406	164	296	221
PS64 HELI 13-1	0.01	0.06	0.54	402	39	120	352
PS64 HELI 13-2	0.01	0.03	0.08	321	95	-63	253
PS64 HELI 13-3	0.01	0.15	0.58	420	67	124	259
PS64 HELI 14-2	0.01	0.08	0.29	390	77	1084	281

Table 10 Results of Rock-Eval Pyrolysis of sea-ice samples.

Station	S1 [mg HC/g Sed]	S2 [mg HC/g Sed]	S3 [mg CO_2/g Sed]	T_{max} [°C]	HI [mg HC/g TOC]	HI(S1+S2)' [mg HC/g TOC]	OI [mg CO_2/g TOC]
PS57 HELI 01-1	0.42	3.59	3.07	416	212	395	182
PS62 HELI 01-1	0.02	0.57	1.22	430	66	317	142
PS62 HELI 02-1	0.17	1.53	6.50	416	93	175	395
PS62 HELI 03-1	0.21	1.78	2.02	411	149	385	169
PS62 HELI 04-1	1.10	8.66	3.77	416	312	465	136
PS62 HELI 05-1	0.21	1.92	2.37	414	165	437	204
PS62 HELI 05-2	0.25	2.25	2.28	416	179	432	182
PS62 HELI 06-1	0.59	5.43	4.39	419	214	324	173
PS62 HELI 06-2	0.33	2.62	2.33	416	224	597	199
PS62 HELI 07-1	0.09	0.97	1.91	416	92	275	180
PS62 HELI 07-2	0.44	3.93	3.12	415	218	386	173
PS62 HELI 08-1	0.67	1.75	2.33	290	121	313	161
PS62 HELI 08-2	0.33	1.23	2.03	290	89	218	146
PS62 HELI 08-3	0.55	1.46	2.26	292	103	269	159
PS62 HELI 09-1	0.31	2.54	2.67	415	172	356	181
PS62 HELI 10-1	0.08	0.68	2.15	419	70	252	220
PS64 HELI 02-1	0.51	4.10	2.85	416	220	389	153
PS64 HELI 02-2	0.09	0.90	1.73	413	100	441	192
PS64 HELI 03-1	0.47	3.32	2.29	415	223	465	154
PS64 HELI 04-1	0.19	1.74	2.23	414	161	479	207
PS64 HELI 04-2	0.17	1.62	2.51	419	139	366	216
PS64 HELI 05-1	0.11	1.07	2.21	418	94	253	194
PS64 HELI 06-1	0.16	1.47	2.71	412	104	220	192
PS64 HELI 07-1	0.11	1.19	2.32	421	97	238	190
PS64 HELI 10-2	0.19	1.61	2.72	418	127	301	214
PS64 HELI 11-1	0.33	2.45	2.61	413	170	363	181
PS64 HELI 11-2	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
PS64 HELI 11-3	0.98	2.14	1.41	290	272	2776	179

Table 11 Results of elemental analysis of sediment core PS62/003.

Core depth [cm]	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
0	0.98	0.02	0.16	7	10
2	n.d.	n.d.	0.09	n.d.	n.d.
4	0.41	0.01	0.12	2	13
5	0.61	0.01	0.13	4	11
8	0.63	0.01	0.16	4	12
10	0.61	0.01	0.17	4	17
12	0.47	0.01	0.19	2	17
15	0.29	0.01	0.21	1	23
18	0.49	0.01	0.23	2	18
20	0.60	0.01	0.19	3	14
23	0.60	0.01	0.15	4	13
25	0.56	0.01	0.15	3	12
26	0.48	0.01	0.16	3	12
30	1.08	0.02	0.20	7	9
33	1.04	0.02	0.18	7	9
35	0.90	0.02	0.24	5	13
36	0.90	0.02	0.19	6	11
40	0.52	0.02	0.21	3	13
43	0.52	0.02	0.19	3	12
45	0.35	0.01	0.13	2	23
50	0.26	0.01	0.08	1	14
55	0.22	0.00	0.09	1	21
60	0.25	n.d.	0.09	1	n.d.
65	0.51	0.01	0.18	3	15
70	0.45	0.02	0.21	2	13
75	0.64	0.02	0.22	4	14
80	0.31	0.01	0.16	1	16
85	0.30	0.01	0.18	1	20
90	0.38	0.01	0.20	2	21
95	0.38	0.01	0.18	2	16
100	0.46	0.02	0.38	1	16
105	0.71	0.03	0.33	3	13
110	0.65	0.03	0.35	2	13
115	0.73	0.03	0.34	3	12
120	0.73	0.03	0.40	3	13
125	0.63	0.02	0.32	3	14
130	0.62	0.03	0.30	3	12
135	0.66	0.03	0.29	3	11
140	0.68	0.03	0.29	3	11
145	0.60	0.02	0.24	3	10
150	0.48	0.02	0.22	2	12
155	0.36	0.02	0.17	2	11
160	0.34	0.02	0.20	1	12
165	0.34	0.01	0.17	1	15
170	0.54	0.01	0.13	3	15
175	0.46	0.01	0.13	3	16
180	0.49	0.01	0.15	3	16
185	0.28	0.01	0.11	1	17
190	0.50	0.01	0.16	3	18
195	0.38	0.01	0.16	2	19
200	0.37	0.02	0.19	2	11
202	0.31	0.02	0.20	1	11
205	0.58	0.01	0.15	4	13
210	n.d.	n.d.	0.25	n.d.	n.d.
214	0.49	0.06	0.28	2	5
215	0.34	0.02	0.29	n.d.	15
220	0.35	0.02	0.37	n.d.	17
222	n.d.	n.d.	0.36	n.d.	n.d.
225	n.d.	n.d.	0.37	n.d.	n.d.
230	n.d.	n.d.	0.42	n.d.	n.d.
231	n.d.	n.d.	0.42	n.d.	n.d.
235	0.55	0.03	0.42	1	13
240	0.56	0.02	0.19	3	11
241	0.51	0.01	0.12	3	12

Table 11 (continued)

Core depth [cm]	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
245	0.44	0.01	0.12	3	10
250	0.55	0.02	0.17	3	8
255	0.55	0.01	0.10	4	8
260	0.45	0.02	0.19	2	12
265	0.51	0.01	0.10	3	9
270	0.55	0.01	0.12	4	10
275	0.48	0.02	0.12	3	8
280	0.53	0.01	0.13	3	9
285	0.66	0.02	0.19	4	9
290	0.85	0.02	0.15	6	10
295	0.90	0.02	0.16	6	9
300	1.11	0.01	0.12	8	9
305	0.62	0.01	0.13	4	9
310	0.88	0.01	0.14	6	10
315	0.78	0.02	0.14	5	6
320	0.72	0.02	0.15	5	8
325	1.06	0.02	0.14	8	8
330	1.41	0.02	0.16	10	10
335	1.40	0.02	0.16	10	10
340	1.50	0.02	0.20	11	10
345	0.45	0.04	0.24	2	7
350	0.43	0.04	0.27	1	7
355	0.89	0.03	0.26	5	9
360	0.73	0.03	0.27	4	8
365	0.85	0.03	0.23	5	9
370	0.97	0.03	0.38	5	14
375	0.94	0.02	0.22	6	11
380	0.42	0.02	0.18	2	9
385	0.50	0.02	0.19	3	9
390	0.57	0.02	0.17	3	9
395	0.82	0.02	0.16	5	8
400	0.84	0.01	0.12	6	10
405	0.86	0.02	0.15	6	10
410	1.04	0.02	0.21	7	9
415	0.90	0.02	0.17	6	7
420	0.93	0.03	0.16	6	6
425	1.01	0.02	0.18	7	9
430	0.95	0.02	0.18	6	10
440	0.82	0.02	0.13	6	7
445	1.22	0.02	0.12	9	7
450	1.86	0.01	0.39	12	31
455	2.56	0.01	0.11	20	10
460	3.16	0.01	0.11	25	9
465	2.66	0.02	0.12	21	7
470	0.73	0.02	0.13	5	7
475	0.82	0.02	0.14	6	7
480	2.20	0.02	0.14	17	9
485	2.87	0.01	0.12	23	8
490	2.81	0.01	0.12	22	8
495	3.23	0.02	0.12	26	8
500	3.53	0.02	0.12	28	7
505	3.67	0.01	0.14	29	10
510	2.59	0.02	0.10	21	6
515	1.52	0.02	0.09	12	5
520	1.52	0.02	0.09	12	5
525	2.02	0.02	0.12	16	7
530	1.93	0.02	0.12	15	5
535	0.52	0.02	0.08	4	5
540	0.99	0.02	0.10	7	5
545	1.03	0.03	0.12	8	5
550	0.95	0.03	0.13	7	5
555	0.56	0.02	0.09	4	6
560	0.74	0.01	0.09	5	8
565	0.47	0.01	0.10	3	7

Table 11 (continued)

Core depth [cm]	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
570	0.59	0.01	0.13	4	10
575	0.49	0.01	0.10	3	11
580	0.29	0.01	0.10	2	10
585	0.23	0.01	0.13	1	10
590	0.35	0.01	0.12	2	10
595	0.34	0.01	0.12	2	11
600	0.33	0.01	0.14	2	12
605	0.35	0.01	0.15	2	11
610	0.48	0.02	0.19	2	12
615	0.46	0.02	0.27	2	14
620	0.63	0.03	0.39	2	13
625	0.72	0.02	0.29	4	12
630	0.43	0.02	0.25	2	10
635	0.51	0.02	0.30	2	19
640	0.53	0.01	0.22	3	22
645	0.45	0.01	0.22	2	25
650	0.46	0.01	0.27	2	26
655	0.53	0.01	0.32	2	27
660	0.62	0.01	0.31	3	24
665	0.57	0.01	0.24	3	24
670	0.45	n.d.	0.17	2	n.d.
675	0.49	n.d.	0.20	2	n.d.
680	0.43	n.d.	0.17	2	n.d.
685	0.49	n.d.	0.25	2	n.d.
690	0.65	n.d.	0.29	3	n.d.
695	0.29	n.d.	0.12	1	n.d.
700	0.25	n.d.	0.12	1	n.d.
705	0.45	n.d.	0.16	2	n.d.
710	0.48	n.d.	0.20	2	n.d.
715	0.28	n.d.	0.13	1	n.d.
720	0.27	n.d.	0.16	1	n.d.
725	0.39	n.d.	0.26	1	n.d.
730	0.50	n.d.	0.23	2	n.d.
735	0.47	0.04	0.28	2	7
740	0.33	0.04	0.20	1	6
745	0.31	0.03	0.19	1	6
750	0.36	0.04	0.23	1	6
755	0.18	0.03	n.d.	n.d.	n.d.
760	0.43	0.03	0.16	2	5
765	0.30	0.03	0.14	1	5
770	0.41	0.04	0.34	1	9
775	0.52	0.03	0.27	2	8
780	0.37	0.03	0.20	1	7
785	0.52	0.04	0.23	2	7
790	0.40	0.03	0.11	2	4
795	0.50	0.03	0.16	3	6
800	0.48	0.03	0.14	3	5
805	0.34	0.03	0.20	1	6
810	0.34	0.03	0.27	1	9
815	0.37	0.03	0.34	0	10
820	0.76	0.03	0.27	4	8
825	0.66	0.04	0.28	3	7
830	0.61	0.04	0.32	2	8
835	0.53	0.04	0.28	2	7
840	0.45	0.04	0.26	2	7
845	0.37	0.04	0.23	1	7
850	0.35	0.03	0.24	1	7
855	0.40	0.04	0.20	2	6
860	0.34	0.03	0.15	2	5
865	0.39	0.03	0.14	2	4
870	0.51	0.03	0.14	3	4
875	0.50	0.03	0.13	3	4
880	0.55	0.03	0.14	3	5
885	0.50	0.03	0.14	3	5

Table 11 (continued)

Core depth [cm]	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
890	0.40	0.03	0.19	2	7
895	0.52	0.02	0.13	3	6
900	0.85	0.03	0.11	6	4
905	0.74	0.02	0.09	5	4
910	0.42	0.03	0.10	3	4
915	0.52	0.03	0.11	3	4
920	0.64	0.04	0.18	4	5
925	0.88	0.03	0.14	6	4
930	0.95	0.03	0.13	7	4
935	1.08	0.03	0.11	8	3
940	0.90	0.03	0.12	6	4
945	0.97	0.03	0.12	7	3
950	1.15	0.03	0.12	9	4
955	0.55	0.03	0.12	4	3
960	0.70	0.04	0.16	5	4
965	0.53	0.04	0.14	3	4
970	0.62	0.05	0.20	3	4
975	0.62	0.04	0.15	4	3
980	0.54	0.04	0.13	3	4
985	0.60	0.04	0.14	4	3
990	0.46	0.04	0.13	3	3
995	0.39	0.04	0.17	2	4
1000	0.63	0.04	0.15	4	4
1005	0.52	0.05	0.19	3	4
1010	0.73	0.05	0.21	4	4
1015	0.79	0.05	0.17	5	3
1020	0.89	0.05	0.19	6	4
1025	0.79	0.06	0.21	5	4
1030	0.64	0.06	0.20	4	3
1035	0.60	0.06	0.20	3	3
1040	0.38	0.06	0.19	2	3
1045	0.53	0.07	0.23	2	3
1050	0.62	0.06	0.19	4	3
1055	0.77	0.06	0.15	5	3
1060	1.20	0.06	0.13	9	2
1065	1.90	0.06	0.12	15	2
1070	1.84	n.d.	0.12	14	n.d.
1075	0.49	n.d.	0.12	n.d.	n.d.
1080	0.71	0.01	0.13	5	25
1085	0.44	0.01	0.12	3	19
1090	0.43	0.01	0.14	2	16
1095	0.37	0.02	0.18	2	11
1100	0.36	0.01	0.17	2	14
1105	0.48	0.01	n.d.	n.d.	n.d.
1110	0.41	0.01	0.12	2	12
1115	0.35	0.01	0.13	2	10
1120	0.37	0.01	0.11	2	9
1125	0.38	0.01	0.11	2	9
1130	0.61	0.01	0.10	4	10
1135	1.10	0.01	0.09	8	10
1140	1.27	0.01	0.09	10	7
1145	1.43	0.02	0.09	11	5
1150	0.80	0.02	0.11	6	6
1155	0.40	0.03	0.10	2	4
1160	0.43	0.03	0.16	2	6
1165	0.34	0.03	0.12	2	4
1170	0.27	0.02	0.14	1	6
1175	0.24	0.03	0.10	1	4
1180	0.20	0.02	0.13	1	5
1185	0.31	0.03	0.10	2	4
1190	0.38	0.02	0.10	2	6
1195	0.29	0.02	0.06	2	4
1200	0.23	0.02	0.09	1	5
1205	0.14	0.02	0.08	0	4

Table 11 (continued)

Core depth [cm]	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
1210	0.26	0.02	0.18	1	11
1215	0.34	0.02	0.18	1	9
1220	0.43	0.02	0.23	2	12
1225	0.49	0.02	0.26	2	11
1230	0.43	0.02	0.36	1	16
1235	0.36	0.02	0.25	1	11
1237	n.d.	n.d.	0.20	n.d.	n.d.
1238	n.d.	n.d.	0.20	n.d.	n.d.
1239	n.d.	n.d.	0.20	n.d.	n.d.

Table 12 Results of elemental analysis of sediment core PS62/004.

Core depth [cm]	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
0	1.40	0.03	0.25	10	7
5	0.42	0.02	0.20	2	8
10	0.17	0.01	0.09	1	9
15	0.77	n.d.	0.19	5	n.d.
20	0.57	0.03	0.20	3	7
25	0.35	n.d.	0.21	1	n.d.
30	0.32	0.03	0.29	0	11
35	0.86	n.d.	0.31	5	n.d.
40	0.66	n.d.	0.26	3	n.d.
45	0.34	0.02	0.16	1	10
50	0.81	0.03	0.21	5	8
55	0.81	0.03	0.21	5	7
60	0.92	0.03	0.17	6	6
65	0.82	0.03	0.19	5	7
70	0.83	0.03	0.20	5	6
75	0.58	0.02	0.19	3	8
80	0.53	0.02	0.18	3	8
85	0.48	n.d.	0.20	2	n.d.
90	0.61	0.03	0.30	3	10
95	0.59	0.02	0.22	3	10
100	0.47	0.03	0.22	2	7
105	0.61	0.03	0.23	3	7
110	0.48	0.01	0.19	2	16
115	0.45	0.03	0.19	2	7
120	0.65	n.d.	0.22	4	n.d.
125	0.65	0.04	0.25	3	7
130	0.65	0.03	0.25	3	7
135	0.71	0.03	0.19	4	6
145	0.96	0.02	0.16	7	7
150	0.74	0.03	0.17	5	6
155	0.81	n.d.	0.18	5	n.d.
160	0.75	0.02	0.14	5	6
162	0.68	n.d.	0.14	4	n.d.
165	0.73	0.02	0.14	5	9
170	0.66	0.02	0.15	4	6
175	0.73	n.d.	0.19	5	n.d.
180	0.69	0.03	0.18	4	7
185	0.53	n.d.	0.15	3	n.d.
190	0.48	0.03	n.d.	n.d.	n.d.
192	0.47	0.03	0.18	2	7
195	0.63	n.d.	0.21	4	n.d.
200	0.90	n.d.	0.21	6	n.d.
205	0.93	0.04	0.30	5	7
210	0.80	0.03	0.21	5	7
215	0.90	n.d.	0.21	6	n.d.
220	0.60	0.03	0.21	3	6
225	0.47	0.04	0.23	2	6
230	0.25	n.d.	0.19	1	n.d.
235	0.22	0.03	n.d.	n.d.	n.d.
240	0.24	n.d.	0.18	0	n.d.
245	0.48	0.03	0.22	2	7
250	0.56	0.03	0.22	3	6
255	0.40	n.d.	0.21	2	n.d.
260	0.62	n.d.	0.24	3	n.d.
265	0.39	0.04	0.23	1	6
270	0.38	0.04	0.26	1	7
275	0.68	n.d.	0.30	3	n.d.
280	0.59	0.04	0.29	3	7
285	0.79	0.04	0.26	4	6
290	1.07	0.03	0.22	7	7
295	0.89	0.03	0.21	6	6
300	0.93	0.03	0.20	6	6
305	1.14	0.03	0.23	8	7
310	1.11	0.04	0.22	7	6

Table 12 (continued)

Core depth [cm]	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
315	0.98	0.04	0.25	6	7
320	0.62	0.04	0.20	4	5
325	0.80	0.04	0.26	5	7
330	0.64	0.04	0.22	4	6
335	1.03	0.04	0.24	7	6
340	0.90	0.04	0.20	6	6
345	1.05	0.03	0.18	7	5
350	0.94	0.04	0.20	6	5
355	0.91	0.03	0.22	6	6
360	0.69	0.05	0.22	4	5
365	0.57	0.05	0.26	3	5
370	0.68	0.05	0.28	3	5
375	0.80	0.05	0.32	4	7
380	1.04	0.04	0.34	6	8
385	0.95	0.04	0.24	6	6
390	0.71	0.03	0.18	4	6
395	0.70	0.04	0.19	4	5
400	0.81	0.05	0.42	3	8
405	0.87	0.03	0.23	5	7
410	0.56	0.03	0.17	3	7
415	1.16	0.04	0.26	8	7
420	1.13	0.03	0.18	8	6
425	1.27	0.03	0.17	9	5
430	1.45	0.04	0.17	11	4
435	1.35	0.03	0.17	10	6
440	1.16	0.02	0.13	9	6
445	1.38	0.02	0.13	10	6
450	1.27	0.02	0.14	9	6
455	1.24	0.03	0.12	9	4
460	1.13	0.02	0.14	8	6
465	0.89	0.03	0.14	6	6
470	1.04	0.03	0.17	7	5
475	1.60	0.03	0.15	12	6
480	1.69	0.02	0.13	13	6
485	1.25	0.02	0.12	9	5
490	1.52	0.02	n.d.	n.d.	n.d.
495	1.26	0.03	0.14	9	5
500	1.76	0.02	0.16	13	7
505	1.40	0.02	0.13	11	5
510	1.21	0.02	0.14	9	6
515	1.14	0.03	0.15	8	6
520	1.87	0.04	0.19	14	5
525	1.53	0.04	0.16	11	4
530	0.80	0.04	0.17	5	4
535	0.67	0.04	0.20	4	5
540	0.78	0.04	0.21	5	5
545	1.20	0.04	0.21	8	5
550	1.13	0.04	0.19	8	5
555	1.11	0.04	0.20	8	5
558	1.24	0.04	0.19	9	5
560	1.25	0.04	0.19	9	5
565	1.49	0.04	0.22	11	5
570	1.58	0.04	0.18	12	5
575	1.21	0.04	0.19	9	5
580	0.63	0.04	0.16	4	4
585	0.85	0.03	n.d.	n.d.	n.d.
590	0.77	0.03	0.14	5	4
595	1.00	0.04	0.16	7	4
600	0.80	0.03	0.12	6	4
605	0.86	0.03	n.d.	n.d.	n.d.
610	0.88	0.03	0.17	6	5
620	0.86	0.03	0.15	6	5
630	1.00	0.03	0.17	7	5
640	0.94	0.04	0.32	5	9

Table 12 (continued)

Core depth [cm]	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
650	0.37	0.04	0.19	1	5
660	0.60	0.03	0.22	3	6
670	0.62	0.04	0.24	3	6
680	0.69	0.04	0.27	4	6
689	0.76	0.05	0.30	4	7
700	0.81	0.04	0.19	5	5
710	0.58	0.04	0.21	3	5
720	0.85	0.04	0.16	6	4
730	1.27	0.05	0.31	8	6
740	1.60	0.04	0.24	11	6
750	1.42	0.04	0.17	10	5
760	1.26	0.03	0.16	9	5
770	1.31	0.04	0.14	10	4
780	1.02	0.03	0.14	7	4
790	1.02	0.03	n.d.	n.d.	n.d.
800	0.63	0.03	n.d.	n.d.	n.d.
810	0.62	0.04	0.16	4	5
820	1.52	0.03	0.18	11	5
830	0.45	0.03	0.14	3	4
840	0.30	0.03	0.15	1	5
850	0.29	0.03	0.17	1	5
860	0.38	0.03	0.15	2	5
870	0.33	0.03	0.25	1	8
880	0.39	0.03	0.19	2	7
890	0.64	0.04	0.24	3	6
900	0.80	0.04	0.19	5	5
910	0.53	0.03	n.d.	n.d.	n.d.
920	0.33	0.04	n.d.	n.d.	n.d.
930	0.38	0.03	0.20	1	6
940	0.34	0.03	0.19	1	6
950	0.32	0.02	0.10	2	4
960	0.60	0.04	0.17	4	5
970	0.19	0.02	0.12	1	5
980	0.33	0.03	0.15	2	4
990	0.31	0.03	0.13	2	4
1,000	0.15	0.03	0.10	0	4
1,010	0.37	0.03	n.d.	n.d.	n.d.
1,020	0.49	0.03	0.14	3	5
1,030	0.22	0.03	0.10	1	4
1,040	0.47	0.03	0.15	3	4
1,051	0.39	0.03	0.12	2	5
1,060	0.27	0.03	n.d.	n.d.	n.d.
1,070	0.48	0.04	n.d.	n.d.	n.d.
1,080	1.16	0.04	0.19	8	5
1,090	0.40	0.04	0.15	2	4
1,101	0.82	0.04	0.13	6	4
1,110	1.02	0.04	0.18	7	4
1,120	0.48	0.04	0.18	2	5
1,130	1.57	0.04	n.d.	n.d.	n.d.
1,140	0.46	0.04	0.19	2	5
1,150	0.36	0.04	0.14	2	4
1,160	1.23	0.03	0.17	9	7
1,170	1.20	0.02	0.16	9	7
1,180	0.62	0.02	0.15	4	7
1,190	0.75	0.02	0.14	5	7
1,200	1.79	0.02	0.14	14	7
1,210	1.46	0.02	0.14	11	6
1,220	0.56	0.02	0.12	4	5
1,230	0.24	0.02	0.15	1	6
1,240	0.23	0.02	0.19	0	8
1,250	0.28	0.02	0.13	1	7
1,260	0.86	0.02	0.13	6	6
1,270	0.61	0.03	0.18	4	7
1,280	0.44	0.02	0.12	3	7

Table 13 Results of elemental analysis of sediment core PS62/015.

Core depth [cm]	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
0	0.60	0.07	0.52	1	7
5	0.51	0.06	0.40	1	7
10	0.34	0.04	0.28	1	7
15	0.29	0.03	0.26	0	8
20	0.41	0.04	0.30	1	8
25	0.47	0.04	0.36	1	9
30	0.52	0.04	0.37	1	9
35	0.46	0.04	0.38	1	10
40	0.45	0.04	0.37	1	9
45	0.38	0.03	0.29	1	9
50	0.45	0.04	0.35	1	10
55	0.41	0.03	0.31	1	9
60	0.25	0.02	0.22	0	12
65	0.19	0.02	0.27	n.d.	15
70	0.21	0.01	0.16	0	11
75	0.31	0.02	0.23	1	11
80	0.28	0.02	0.25	0	11
85	0.39	0.03	0.31	1	10
90	0.36	0.03	0.32	0	11
95	0.37	0.03	0.28	1	11
100	0.37	0.03	0.31	1	12
105	0.41	0.03	0.33	1	12
110	0.40	0.03	0.45	n.d.	16
115	0.45	0.03	0.35	1	11
120	0.41	0.03	0.31	1	11
125	0.39	0.03	0.47	n.d.	18
130	0.41	0.03	0.35	0	13
135	0.42	0.03	0.32	1	12
140	0.41	0.03	0.36	0	13
145	0.46	0.03	0.37	1	13
150	0.51	0.03	0.39	1	12
155	0.46	0.03	0.33	1	10
160	0.50	0.04	0.38	1	9
165	0.48	0.04	0.37	1	9
170	0.45	0.04	0.36	1	9
175	0.51	0.04	0.40	1	9
180	0.54	0.03	0.38	1	11
185	0.45	0.03	0.32	1	9
190	0.43	0.03	0.26	1	10
195	0.19	0.01	n.d.	n.d.	n.d.
200	0.21	0.01	0.18	0	13
205	0.64	0.03	0.40	2	12
210	0.65	0.04	0.45	2	13
215	0.44	0.02	0.26	2	11
225	0.26	0.02	0.17	1	11
230	0.56	0.03	0.35	2	12
235	0.70	0.03	0.35	3	12
240	0.51	0.02	0.27	2	15
245	0.74	0.03	0.45	2	16
250	0.73	0.03	0.39	3	12
255	0.71	0.04	0.58	1	14
260	0.78	0.03	0.44	3	14
265	0.68	0.03	0.29	3	10
270	0.61	0.02	n.d.	n.d.	n.d.
275	0.51	0.02	0.20	3	10
280	0.44	0.02	0.21	2	10
285	0.55	0.02	0.22	3	10
290	0.53	0.02	0.20	3	10
295	0.29	0.02	0.18	1	9
305	0.54	0.03	0.23	3	8
310	0.48	0.02	0.23	2	10
315	0.48	0.02	0.23	2	9
320	0.55	0.03	0.26	2	10
325	0.42	0.02	0.24	2	10

Table 13 (continued)

Core depth [cm]	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
330	0.35	0.03	0.25	1	9
335	0.38	0.03	0.32	1	10
340	0.50	0.03	0.29	2	10
345	0.62	0.03	0.25	3	10
350	0.51	0.03	n.d.	n.d.	n.d.
360	0.35	0.03	0.28	1	10
365	0.65	0.03	0.28	3	9
370	0.38	0.03	0.27	1	9
375	0.31	0.03	0.26	0	10
380	0.42	0.03	n.d.	n.d.	n.d.
385	0.52	0.03	0.26	2	9
390	0.34	0.03	0.23	1	9
395	0.34	0.03	n.d.	n.d.	n.d.
400	0.33	0.03	0.24	1	8
405	0.50	0.03	0.29	2	11
410	0.40	0.02	0.20	2	10
415	0.41	0.03	0.27	1	9
420	0.26	0.02	0.21	0	9
425	0.42	0.02	0.21	2	9
430	0.31	0.03	0.23	1	9
435	0.31	0.03	0.26	0	9
440	0.45	0.03	0.31	1	10
445	0.66	0.02	0.21	4	8
450	0.45	0.03	0.27	2	9
455	0.50	0.03	0.25	2	9
460	0.70	0.03	0.27	4	8
465	0.68	0.03	0.23	4	7
470	0.45	0.03	0.20	2	8
475	0.53	0.03	0.27	2	9
480	0.41	0.03	0.27	1	9
485	0.31	0.03	0.24	1	9
490	0.31	0.03	0.26	0	9
495	0.30	0.03	0.24	0	9
500	0.52	0.04	0.49	0	11
505	0.53	0.04	0.42	1	10
510	n.d.	0.03	0.34	n.d.	10
515	0.44	0.03	0.35	1	10
520	0.35	0.03	0.26	1	10
525	0.42	0.03	0.34	1	12
530	0.42	0.03	0.30	1	9
535	0.42	0.03	0.32	1	10
540	0.44	0.03	0.32	1	10
545	0.40	0.03	0.31	1	10
550	0.42	0.04	0.33	1	9
555	0.36	0.03	0.27	1	8
560	0.29	0.03	0.23	1	8
565	0.30	0.03	0.23	1	8
570	0.29	0.03	0.22	1	9
575	0.37	0.03	0.22	1	8
580	0.36	0.03	0.30	0	10
585	0.40	0.03	0.35	0	12
590	0.34	0.03	0.32	0	10
595	0.30	0.03	0.26	0	9
600	0.31	0.03	0.35	n.d.	13
605	0.32	0.03	0.29	0	10
610	0.39	0.03	0.33	1	10
615	0.39	0.04	0.35	0	9
620	0.37	0.04	0.29	1	7
625	0.31	0.03	0.26	0	7

Table 14 Results of elemental analysis of sediment core PS62/017.

Core depth [cm]	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
0	0.70	0.11	0.64	1	6
5	0.58	0.09	0.52	1	6
10	0.50	0.06	0.41	1	7
15	0.43	0.03	0.45	n.d.	14
20	0.51	0.06	0.41	1	7
25	0.37	0.03	0.48	n.d.	14
30	0.61	0.07	0.51	1	8
35	0.53	0.05	0.43	1	8
40	0.51	0.05	0.40	1	8
45	0.33	0.03	0.27	0	8
50	0.55	0.02	0.31	2	19
55	0.45	0.04	0.34	1	9
60	0.29	0.04	0.26	0	7
65	0.28	0.03	0.30	n.d.	12
70	0.41	0.03	0.26	1	7
75	0.54	0.07	0.27	2	4
80	0.34	0.03	0.29	0	9
85	0.47	0.04	0.38	1	10
90	0.52	0.04	0.35	1	9
95	0.45	0.02	0.15	3	10
100	n.d.	n.d.	0.14	n.d.	n.d.
105	0.55	0.02	0.12	4	7
110	0.85	0.01	0.09	6	7
115	0.84	0.01	0.08	6	16
120	0.34	0.03	0.09	2	3
125	0.91	0.01	0.10	7	16
130	0.50	0.01	0.06	4	10
135	0.61	0.07	0.08	4	1
140	0.27	0.01	0.07	2	7
145	0.54	0.04	0.43	1	10
150	0.52	0.05	0.34	2	7
155	0.64	0.05	0.39	2	7
160	0.54	0.05	0.37	1	8
165	0.45	0.02	0.30	1	13
170	0.40	0.03	0.21	2	7
175	0.13	0.01	0.10	0	9
180	0.42	0.04	0.24	2	7
185	0.91	0.04	0.39	4	9
190	0.56	0.03	0.22	3	7
195	0.61	0.04	0.25	3	7
200	0.77	0.05	0.34	4	7
205	0.63	0.04	0.25	3	7
210	0.43	0.03	0.23	2	7
215	0.22	0.03	0.19	0	7
220	0.22	0.03	0.19	0	6
225	0.56	0.04	0.18	3	5
230	0.64	0.05	0.36	2	8
235	0.65	0.04	0.29	3	8
240	0.54	0.04	0.30	2	7
245	0.56	0.04	0.29	2	8
250	1.03	n.d.	0.28	6	n.d.
255	0.59	0.05	0.32	2	7
260	0.41	0.04	0.25	1	7
265	0.32	0.03	0.23	1	7
270	0.37	0.03	0.25	1	8
275	0.43	0.04	0.33	1	8
280	0.67	0.04	0.39	2	9
285	0.82	0.10	0.29	4	3
290	0.55	0.03	0.26	2	8
295	0.45	0.03	0.26	2	7
300	0.45	0.04	0.23	2	7
305	0.47	0.04	0.24	2	7
310	0.58	0.04	0.28	3	7
315	0.26	0.01	0.08	1	8

Table 14 (continued)

Core depth [cm]	TC [wt.-%]	N [wt.-%]	TOC [wt.-%]	$CaCO_3$ [wt.-%]	C/N
320	0.35	0.01	0.09	2	7
325	0.50	0.04	0.26	2	7
330	0.37	0.04	0.33	0	8
335	0.34	0.04	0.26	1	7
340	0.46	0.04	0.32	1	8
345	0.44	0.04	0.32	1	8
350	0.60	0.04	0.35	2	9
355	0.60	0.04	0.32	2	8
360	0.39	0.03	0.26	1	8
365	0.35	0.03	0.25	1	8
370	0.35	0.03	0.26	1	8
375	0.36	0.03	0.26	1	8
380	0.36	0.03	0.25	1	8
385	0.44	0.03	0.26	2	8
390	0.47	0.03	0.27	2	8
395	0.31	0.03	0.26	0	8
400	0.34	0.04	n.d.	n.d.	n.d.
405	0.50	0.04	0.33	1	8
410	0.46	0.03	0.26	2	8
415	0.35	0.03	0.22	1	8
420	0.32	0.03	0.23	1	7
425	0.37	0.03	0.29	1	8
430	0.39	0.04	0.28	1	8
435	0.38	0.04	0.31	1	9
440	0.38	0.04	n.d.	n.d.	n.d.
445	0.50	0.04	0.34	1	8
450	0.50	0.04	0.28	2	8
455	0.40	0.03	0.22	1	8
460	0.48	0.03	0.25	2	7
465	0.52	0.04	0.30	2	8
470	0.71	0.04	0.31	3	9
475	0.72	0.04	0.24	4	7
480	0.49	0.04	0.27	2	7
485	0.46	0.04	0.29	1	7
490	0.41	0.04	0.31	1	8
495	0.40	0.04	0.28	1	8
500	0.43	0.04	0.29	1	8
505	0.80	0.06	0.57	2	9
510	0.65	0.05	0.46	2	9
515	0.82	0.05	0.36	4	8
520	0.75	0.04	0.28	4	7
525	0.68	0.04	0.28	3	7
530	0.60	0.04	0.30	2	7
535	0.58	0.04	0.36	2	9
540	0.73	0.04	0.35	3	8
545	0.82	0.05	0.38	4	8
550	0.78	0.04	0.27	4	6
555	0.80	0.04	0.36	4	8
560	0.68	0.05	0.32	3	7
565	0.51	0.04	0.28	2	8
570	0.46	0.04	0.31	1	7
575	0.57	0.04	0.27	3	7
580	0.50	0.05	0.35	1	7
585	0.51	0.05	0.38	1	8
590	0.58	0.05	0.36	2	7
595	0.80	0.04	0.32	4	9
600	0.52	0.03	n.d.	n.d.	n.d.
605	0.32	0.03	0.23	1	8
610	0.30	0.04	0.26	0	7
615	0.32	0.04	0.26	1	7
620	0.36	0.04	0.31	0	7
625	0.44	0.04	0.35	1	8
630	0.32	0.03	0.23	1	8

Table 15 Concentrations (µg/g Sed.) of *n*-alkanes and CPI in marine sediments.

n-Alkane	assigned group	Station	2616	2618	2619	2620	2622	2623	2624	2625	2626	2627	2628
		Zone	MIZ	CZ	CZ	CZ	CZ	CZ				MIZ	MIZ
15	A		0.03	0.04	0.03	0.03	0.18	0.19	0.09	0.02	0.00	0.05	0.18
16			0.03	0.04	0.04	0.05	0.19	0.23	0.11	0.02	0.00	0.06	0.19
17	A		0.05	0.05	0.05	0.26	0.15	0.18	0.11	0.03	0.00	0.07	0.38
18			0.05	0.05	0.04	0.08	0.12	0.14	0.10	0.02	0.00	0.06	0.19
19	A		0.07	0.07	0.06	0.10	0.12	0.14	0.11	0.06	0.01	0.07	0.19
20			0.07	0.04	0.04	0.08	0.10	0.10	0.09	0.02	0.00	0.07	0.14
21			0.10	0.04	0.05	0.09	0.10	0.11	0.09	0.03	0.01	0.11	0.17
22			0.10	0.04	0.04	0.09	0.09	0.10	0.09	0.03	0.01	0.11	0.15
23			0.18	0.06	0.07	0.13	0.12	0.13	0.12	0.04	0.01	0.20	0.23
24			0.11	0.04	0.05	0.09	0.09	0.09	0.08	0.03	0.01	0.11	0.13
25			0.21	0.06	0.07	0.14	0.14	0.16	0.14	0.04	0.01	0.24	0.26
26			0.09	0.03	0.04	0.08	0.08	0.08	0.07	0.02	0.00	0.10	0.11
27	C		0.28	0.08	0.09	0.15	0.16	0.19	0.15	0.06	0.02	0.31	0.35
28			0.07	0.03	0.03	0.06	0.06	0.06	0.06	0.03	0.00	0.07	0.09
29	C		0.29	0.10	0.10	0.16	0.15	0.19	0.15	0.08	0.02	0.33	0.39
30			0.04	0.01	0.03	0.04	0.04	0.04	0.04	0.01	0.00	0.04	0.05
31	C		0.26	0.08	0.10	0.15	0.14	0.18	0.15	0.06	0.02	0.29	0.37
32			0.04	0.02	0.02	0.03	0.03	0.03	0.02	0.01	0.00	0.02	0.04
33	C		0.08	0.03	0.04	0.07	0.06	0.07	0.06	0.02	0.01	0.10	0.13
34			0.01	0.01	0.00	0.02	0.01	0.01	0.01	0.00	0.00	0.01	0.01
Total			2.17	0.91	1.00	1.92	2.14	2.44	1.84	0.62	0.14	2.43	3.74
Σ assigned to A			0.16	0.15	0.14	0.40	0.45	0.52	0.31	0.10	0.01	0.19	0.75
% assigned to A			7	17	14	21	21	21	17	17	9	8	20
Σ assigned to C			0.92	0.29	0.34	0.53	0.51	0.63	0.51	0.21	0.06	1.03	1.23
% assigned to C			42	32	34	27	24	26	28	35	45	42	33
CPI			4.0	3.1	3.0	2.6	2.5	2.9	2.8	2.9	5.1	4.3	4.2

n-Alkane	assigned group	Station	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2640
		Zone	MIZ	ICZ	CZ	CZ	CZ	CZ			CZ	CZ	CZ
15	A		0.02	0.01	0.01	0.01	0.00	0.01	0.02	0.01	0.03	0.03	0.03
16			0.03	0.01	0.02	0.01	0.00	0.01	0.02	0.02	0.03	0.04	0.04
17	A		0.09	0.02	0.03	0.02	0.01	0.02	0.02	0.02	0.05	0.10	0.04
18			0.05	0.02	0.03	0.02	0.01	0.01	0.01	0.02	0.05	0.06	0.03
19	A		0.07	0.02	0.06	0.03	0.01	0.04	0.02	0.03	0.06	0.08	0.06
20			0.06	0.02	0.04	0.03	0.01	0.01	0.02	0.02	0.07	0.06	0.03
21			0.08	0.03	0.05	0.03	0.01	0.02	0.02	0.02	0.11	0.07	0.04
22			0.08	0.02	0.05	0.03	0.01	0.02	0.02	0.02	0.11	0.07	0.03
23			0.14	0.03	0.07	0.04	0.01	0.03	0.03	0.03	0.21	0.09	0.06
24			0.08	0.02	0.04	0.02	0.01	0.02	0.02	0.02	0.13	0.06	0.03
25			0.17	0.04	0.09	0.06	0.02	0.03	0.03	0.03	0.26	0.10	0.07
26			0.08	0.02	0.05	0.02	0.01	0.01	0.02	0.02	0.11	0.06	0.03
27	C		0.24	0.05	0.12	0.07	0.02	0.04	0.05	0.05	0.37	0.13	0.10
28			0.07	0.02	0.04	0.02	0.01	0.01	0.02	0.01	0.09	0.05	0.03
29	C		0.27	0.06	0.16	0.09	0.03	0.07	0.11	0.08	0.42	0.15	0.17
30			0.04	0.01	0.03	0.02	0.00	0.01	0.01	0.01	0.06	0.03	0.02
31	C		0.27	0.06	0.13	0.05	0.02	0.06	0.08	0.07	0.39	0.14	0.13
32			0.03	0.00	0.02	0.01	0.00	0.01	0.01	0.01	0.05	0.03	0.02
33	C		0.09	0.02	0.05	0.02	0.01	0.02	0.04	0.03	0.14	0.05	0.05
34			0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
Total			1.97	0.48	1.08	0.61	0.19	0.45	0.55	0.51	2.75	1.43	1.00
Σ assigned to A			0.18	0.05	0.09	0.06	0.02	0.06	0.06	0.06	0.14	0.21	0.12
% assigned to A			9	9	9	10	11	14	10	12	5	15	12
Σ assigned to C			0.87	0.19	0.46	0.23	0.08	0.19	0.28	0.23	1.32	0.48	0.45
% assigned to C			44	39	42	38	45	42	50	44	48	34	45
CPI			4.0	3.5	3.5	3.5	4.1	4.7	5.3	4.9	4.3	2.9	4.4

Table 15 (continued)

n-Alkane	assigned group	Station	2641	2642	2643	2644	2645	2646	2647	2648	2651	2654	2656
		Zone		CZ	CZ		SOWS	SOWS	SOWS	CZ	CZ	CZ	SOWS
15	A		0.04	0.00	0.00	0.02	0.02	0.00	0.02	0.13	0.00	0.00	0.02
16			0.05	0.00	0.00	0.02	0.03	0.01	0.03	0.15	0.00	0.00	0.03
17	A		0.13	0.00	0.03	0.02	0.04	0.03	0.05	0.18	0.00	0.01	0.03
18			0.08	0.00	0.03	0.02	0.04	0.03	0.04	0.15	0.00	0.01	0.03
19	A		0.09	0.01	0.01	0.05	0.07	0.05	0.06	0.18	0.01	0.02	0.05
20			0.08	0.01	0.01	0.03	0.05	0.04	0.05	0.17	0.01	0.01	0.03
21			0.08	0.01	0.01	0.05	0.08	0.06	0.07	0.14	0.01	0.01	0.09
22			0.07	0.01	0.01	0.05	0.08	0.07	0.07	0.14	0.01	0.01	0.03
23			0.10	0.01	0.02	0.11	0.15	0.13	0.12	0.17	0.02	0.02	0.05
24			0.07	0.01	0.01	0.06	0.09	0.08	0.08	0.13	0.01	0.01	0.03
25			0.12	0.01	0.02	0.15	0.19	0.16	0.15	0.16	0.02	0.01	0.06
26			0.07	0.01	0.01	0.06	0.08	0.07	0.07	0.11	0.01	0.01	0.03
27	C		0.16	0.02	0.03	0.23	0.27	0.22	0.21	0.19	0.03	0.02	0.08
28			0.06	0.00	0.01	0.07	0.07	0.06	0.06	0.09	0.01	0.01	0.03
29	C		0.19	0.02	0.03	0.29	0.30	0.25	0.24	0.21	0.03	0.02	0.11
30			0.04	0.00	0.00	0.03	0.04	0.03	0.03	0.06	0.01	0.00	0.02
31	C		0.19	0.02	0.02	0.28	0.29	0.25	0.23	0.18	0.03	0.02	0.13
32			0.03	0.00	0.00	0.03	0.03	0.03	0.03	0.06	0.01	0.00	0.02
33	C		0.08	0.01	0.01	0.10	0.10	0.09	0.08	0.08	0.01	0.01	0.05
34			0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.00	0.00	0.01
Total			1.75	0.16	0.27	1.68	2.03	1.65	1.68	2.68	0.24	0.20	0.90
Σ assigned to A			0.26	0.02	0.05	0.08	0.13	0.08	0.12	0.48	0.02	0.03	0.10
% assigned to A			15	11	17	5	6	5	7	18	6	14	11
Σ assigned to C			0.62	0.06	0.09	0.90	0.97	0.81	0.76	0.65	0.09	0.06	0.37
% assigned to C			36	38	34	54	48	49	45	24	39	31	41
CPI			3.1	3.8	3.8	4.6	4.4	4.3	4.0	2.1	3.1	3.1	3.9

n-Alkane	assigned group	Station	57/066	57/067	57/068	57/069	57/070	57/075	57/076	57/077	57/080	57/082	57/083
		Zone	ICZ	ICZ		ICZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
15	A		0.01	0.01	0.01	0.02	0.10	0.03	0.04	0.05	0.02	0.03	0.05
16			0.02	0.02	0.01	0.03	0.13	0.03	0.05	0.05	0.03	0.04	0.04
17	A		0.02	0.03	0.03	0.05	0.13	0.05	0.06	0.06	0.05	0.05	0.08
18			0.02	0.03	0.03	0.04	0.11	0.05	0.06	0.05	0.05	0.06	0.07
19	A		0.03	0.04	0.05	0.06	0.14	0.08	0.08	0.08	0.07	0.08	0.08
20			0.03	0.04	0.05	0.06	0.11	0.08	0.08	0.08	0.08	0.08	0.09
21			0.04	0.06	0.08	0.09	0.16	0.13	0.13	0.13	0.13	0.14	0.14
22			0.04	0.06	0.08	0.09	0.14	0.13	0.13	0.13	0.13	0.14	0.13
23			0.07	0.10	0.14	0.14	0.26	0.24	0.24	0.23	0.24	0.25	0.24
24			0.04	0.07	0.08	0.08	0.14	0.14	0.14	0.13	0.14	0.14	0.14
25			0.08	0.13	0.17	0.16	0.29	0.28	0.28	0.27	0.29	0.30	0.27
26			0.03	0.05	0.07	0.07	0.12	0.12	0.11	0.11	0.12	0.12	0.12
27	C		0.10	0.16	0.24	0.21	0.39	0.37	0.38	0.37	0.40	0.41	0.37
28			0.03	0.04	0.06	0.05	0.09	0.09	0.08	0.09	0.10	0.09	0.09
29	C		0.11	0.18	0.25	0.22	0.42	0.39	0.40	0.39	0.43	0.45	0.38
30			0.02	0.03	0.04	0.03	0.06	0.05	0.05	0.05	0.06	0.06	0.05
31	C		0.09	0.17	0.24	0.19	0.40	0.37	0.39	0.36	0.41	0.42	0.35
32			0.01	0.02	0.03	0.03	0.04	0.04	0.04	0.03	0.05	0.05	0.05
33	C		0.03	0.06	0.08	0.06	0.14	0.13	0.14	0.12	0.14	0.13	0.12
34			0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total			0.83	1.28	1.76	1.69	3.40	2.79	2.89	2.80	2.97	3.07	2.88
Σ assigned to A			0.06	0.08	0.09	0.13	0.37	0.16	0.18	0.19	0.14	0.17	0.21
% assigned to A			8	6	5	7	11	6	6	7	5	6	7
Σ assigned to C			0.33	0.56	0.82	0.69	1.35	1.26	1.30	1.24	1.39	1.42	1.23
% assigned to C			39	44	46	41	40	45	45	44	47	46	43
CPI			3.7	4.0	4.1	3.8	4.3	4.3	4.6	4.3	4.2	4.4	4.0

Table 15 (continued)

n-Alkane	assigned group	Station	57/084	57/085	57/087	57/088	57/090	57/091	57/092	57/093	57/094	57/095	57/097
		Zone	MIZ	MIZ	ICZ	MIZ	MIZ		MIZ	MIZ	MIZ	MIZ	MIZ
15	A		0.04	0.14	0.03	0.05	0.02	0.18	0.04	0.03	0.09	0.04	0.05
16			0.04	0.12	0.03	0.06	0.03	0.16	0.05	0.05	0.08	0.05	0.05
17	A		0.05	0.10	0.04	0.08	0.05	0.14	0.08	0.12	0.09	0.08	0.07
18			0.05	0.08	0.04	0.07	0.05	0.12	0.07	0.07	0.08	0.06	0.06
19	A		0.07	0.11	0.06	0.09	0.08	0.14	0.09	0.10	0.10	0.10	0.08
20			0.08	0.09	0.06	0.08	0.07	0.11	0.08	0.09	0.09	0.09	0.08
21			0.14	0.14	0.09	0.12	0.12	0.15	0.13	0.15	0.15	0.14	0.13
22			0.14	0.14	0.09	0.12	0.12	0.13	0.12	0.14	0.14	0.14	0.12
23			0.25	0.25	0.17	0.21	0.22	0.22	0.22	0.25	0.26	0.27	0.23
24			0.15	0.14	0.09	0.12	0.12	0.12	0.12	0.15	0.15	0.15	0.13
25			0.29	0.29	0.19	0.25	0.25	0.23	0.25	0.30	0.30	0.30	0.27
26			0.13	0.12	0.08	0.11	0.10	0.09	0.10	0.13	0.13	0.13	0.12
27	C		0.40	0.39	0.27	0.34	0.32	0.29	0.32	0.41	0.39	0.41	0.38
28			0.10	0.09	0.06	0.08	0.08	0.06	0.07	0.10	0.09	0.10	0.09
29	C		0.42	0.42	0.28	0.36	0.33	0.29	0.31	0.44	0.40	0.44	0.41
30			0.06	0.05	0.04	0.05	0.05	0.03	0.00	0.06	0.05	0.06	0.06
31	C		0.40	0.40	0.26	0.34	0.31	0.26	0.29	0.42	0.36	0.42	0.39
32			0.04	0.03	0.04	0.03	0.05	0.02	0.04	0.05	0.03	0.06	0.06
33	C		0.14	0.14	0.09	0.12	0.11	0.09	0.10	0.14	0.12	0.15	0.13
34			0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.01
Total			2.98	3.24	2.04	2.69	2.49	2.87	2.49	3.22	3.11	3.20	2.91
Σ assigned to A			0.16	0.34	0.12	0.22	0.14	0.47	0.21	0.25	0.27	0.21	0.20
% assigned to A			5	11	6	8	6	16	8	8	9	7	7
Σ assigned to C			1.36	1.35	0.90	1.15	1.07	0.94	1.01	1.41	1.28	1.42	1.31
% assigned to C			46	42	44	43	43	33	41	44	41	44	45
CPI			4.3	4.5	4.0	4.2	3.9	4.5	4.7	4.1	4.2	4.1	4.1

n-Alkane	assigned group	Station	57/098	57/100	57/101	57/102	57/104	57/105	59/064	59/066	59/068	59/070	59/072
		Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
15	A		0.05	0.06	0.04	0.13	0.08	0.04	0.05	0.04	0.04	0.06	0.10
16			0.06	0.06	0.04	0.16	0.07	0.05	0.06	0.06	0.05	0.07	0.13
17	A		0.06	0.07	0.06	0.17	0.07	0.07	0.07	0.06	0.06	0.07	0.14
18			0.06	0.06	0.06	0.16	0.06	0.07	0.06	0.06	0.06	0.06	0.12
19	A		0.09	0.08	0.08	0.17	0.09	0.09	0.09	0.09	0.09	0.09	0.14
20			0.08	0.08	0.08	0.13	0.09	0.09	0.08	0.09	0.09	0.09	0.11
21			0.13	0.12	0.14	0.18	0.14	0.14	0.13	0.13	0.14	0.14	0.15
22			0.13	0.12	0.14	0.16	0.14	0.14	0.14	0.13	0.14	0.14	0.14
23			0.23	0.23	0.25	0.27	0.24	0.26	0.25	0.24	0.24	0.25	0.23
24			0.13	0.13	0.14	0.14	0.14	0.15	0.14	0.13	0.14	0.14	0.12
25			0.25	0.26	0.27	0.29	0.29	0.30	0.27	0.24	0.28	0.28	0.24
26			0.11	0.11	0.11	0.11	0.12	0.12	0.11	0.10	0.11	0.12	0.10
27	C		0.34	0.35	0.34	0.37	0.38	0.40	0.36	0.30	0.36	0.38	0.32
28			0.08	0.08	0.08	0.09	0.09	0.95	0.08	0.07	0.08	0.09	0.07
29	C		0.36	0.37	0.35	0.39	0.41	0.41	0.37	0.31	0.39	0.40	0.34
30			0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.05	0.05	0.04
31	C		0.33	0.35	0.32	0.35	0.38	0.37	0.33	0.28	0.36	0.36	0.31
32			0.03	0.03	0.05	0.03	0.05	0.05	0.03	0.03	0.04	0.04	0.03
33	C		0.11	0.12	0.11	0.12	0.13	0.12	0.11	0.09	0.12	0.12	0.11
34			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total			2.65	2.72	2.72	3.48	3.03	3.88	2.79	2.51	2.87	2.98	2.96
Σ assigned to A			0.20	0.20	0.18	0.48	0.24	0.20	0.20	0.20	0.20	0.23	0.39
% assigned to A			7	7	7	14	8	5	7	8	7	8	13
Σ assigned to C			1.13	1.19	1.12	1.23	1.31	1.30	1.17	0.98	1.23	1.26	1.08
% assigned to C			43	44	41	35	43	34	42	39	43	42	36
CPI			4.3	4.4	4.0	4.5	4.2	1.3	4.3	4.2	4.3	4.2	4.4

Table 15 (continued)

n-Alkane	assigned group	Station	59/074	59/076	59/077	59/079	59/082	59/084	59/085	59/086	62/002	62/004	62/012
		Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ		MIZ	SOWZ	SOWZ	SOWZ
15	A		0.05	0.07	0.07	0.04	0.03	0.04	0.05	0.03	0.01	0.04	0.01
16			0.06	0.08	0.07	0.05	0.04	0.05	0.05	0.04	0.01	0.01	0.01
17	A		0.07	0.10	0.08	0.06	0.06	0.06	0.05	0.07	0.01	0.01	0.01
18			0.06	0.08	0.07	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01
19	A		0.09	0.11	0.09	0.08	0.09	0.08	0.08	0.08	0.01	0.02	0.01
20			0.09	0.10	0.09	0.07	0.08	0.08	0.08	0.08	0.01	0.01	0.01
21			0.13	0.15	0.15	0.12	0.14	0.13	0.12	0.13	0.01	0.02	0.01
22			0.13	0.14	0.14	0.11	0.14	0.12	0.12	0.12	0.02	0.02	0.01
23			0.25	0.25	0.26	0.20	0.25	0.23	0.21	0.23	0.02	0.03	0.02
24			0.13	0.14	0.15	0.11	0.15	0.13	0.12	0.13	0.02	0.02	0.01
25			0.26	0.30	0.30	0.22	0.30	0.26	0.24	0.26	0.03	0.04	0.02
26			0.11	0.13	0.12	0.09	0.13	0.11	0.10	0.11	0.02	0.02	0.01
27	C		0.35	0.41	0.39	0.29	0.41	0.35	0.30	0.34	0.03	0.06	0.02
28			0.08	0.10	0.09	0.07	0.10	0.08	0.07	0.08	0.01	0.02	0.01
29	C		0.37	0.45	0.39	0.31	0.44	0.37	0.30	0.36	0.04	0.07	0.02
30			0.05	0.09	0.05	0.04	0.06	0.05	0.04	0.05	0.01	0.01	0.00
31	C		0.33	0.45	0.34	0.29	0.42	0.34	0.28	0.34	0.04	0.07	0.02
32			0.04	0.09	0.03	0.04	0.05	0.03	0.03	0.04	0.01	0.01	0.00
33	C		0.13	0.18	0.12	0.10	0.14	0.12	0.10	0.11	0.02	0.03	0.01
34			0.01	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
Total			2.80	3.47	3.01	2.33	3.08	2.68	2.40	2.66	0.33	0.53	0.22
Σ assigned to A			0.21	0.29	0.25	0.17	0.18	0.18	0.18	0.18	0.03	0.07	0.03
% assigned to A			8	8	8	7	6	7	8	7	9	13	14
Σ assigned to C			1.18	1.49	1.23	0.98	1.41	1.17	0.98	1.16	0.13	0.23	0.07
% assigned to C			42	43	41	42	46	44	41	44	39	44	33
CPI			4.3	3.6	4.2	4.2	4.2	4.4	4.2	4.3	3.1	3.9	2.7

n-Alkane	assigned group	Station	62/015	62/017	62/020	62/021	62/026	62/027	62/028	62/029	62/035	62/038	62/041
		Zone	SOWZ	SOWZ	SOWZ	SOWZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
15	A		0.03	0.08	0.08	0.09	0.05	0.10	0.05	0.03	0.04	0.01	0.08
16			0.02	0.07	0.08	0.06	0.04	0.07	0.04	0.02	0.04	0.01	0.06
17	A		0.03	0.07	0.08	0.07	0.05	0.08	0.05	0.03	0.05	0.02	0.06
18			0.03	0.05	0.07	0.06	0.05	0.07	0.04	0.03	0.04	0.02	0.05
19	A		0.05	0.08	0.07	0.08	0.07	0.10	0.06	0.05	0.06	0.03	0.06
20			0.03	0.05	0.06	0.07	0.07	0.08	0.06	0.05	0.05	0.02	0.06
21			0.05	0.06	0.09	0.10	0.12	0.12	0.09	0.09	0.07	0.04	0.08
22			0.04	0.06	0.08	0.10	0.11	0.11	0.09	0.09	0.07	0.03	0.08
23			0.07	0.09	0.14	0.19	0.21	0.19	0.16	0.17	0.11	0.06	0.14
24			0.05	0.06	0.09	0.11	0.12	0.11	0.09	0.10	0.07	0.04	0.08
25			0.09	0.11	0.17	0.23	0.24	0.20	0.19	0.20	0.14	0.07	0.16
26			0.04	0.05	0.07	0.09	0.10	0.08	0.08	0.09	0.06	0.03	0.07
27	C		0.12	0.14	0.23	0.30	0.31	0.24	0.26	0.27	0.18	0.09	0.20
28			0.03	0.04	0.05	0.07	0.07	0.05	0.06	0.06	0.05	0.03	0.05
29	C		0.14	0.16	0.25	0.31	0.33	0.23	0.28	0.27	0.20	0.09	0.22
30			0.02	0.02	0.04	0.04	0.04	0.03	0.04	0.03	0.03	0.02	0.03
31	C		0.14	0.14	0.25	0.28	0.33	0.21	0.27	0.26	0.19	0.09	0.21
32			0.02	0.02	0.03	0.04	0.03	0.02	0.04	0.02	0.02	0.01	0.02
33	C		0.05	0.05	0.09	0.10	0.11	0.07	0.09	0.08	0.07	0.03	0.07
34			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total			1.07	1.43	2.04	2.39	2.46	2.15	2.04	1.96	1.54	0.75	1.80
Σ assigned to A			0.10	0.23	0.24	0.24	0.17	0.28	0.16	0.10	0.14	0.06	0.20
% assigned to A			10	16	12	10	7	13	8	5	9	7	11
Σ assigned to C			0.46	0.50	0.82	0.99	1.08	0.75	0.90	0.88	0.63	0.31	0.70
% assigned to C			43	35	40	42	44	35	44	45	41	41	39
CPI			3.9	3.6	4.1	4.3	4.5	4.2	4.3	4.4	3.9	3.3	4.1

Table 15 (continued)

n-Alkane	assigned group	Station	62/044	62/046	62/048	62/050	62/054	62/056	62/058	64/487	64/488	64/489	64/490
		Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	CZ	CZ	ICZ	ICZ
15	A		0.04	0.05	0.08	0.05	0.07	0.06	0.07	0.00	0.06	0.02	0.02
16			0.03	0.04	0.06	0.03	0.05	0.07	0.05	0.01	0.05	0.03	0.02
17	A		0.03	0.05	0.08	0.04	0.07	0.09	0.06	0.01	0.05	0.04	0.02
18			0.04	0.05	0.06	0.04	0.07	0.08	0.05	0.01	0.04	0.03	0.01
19	A		0.06	0.06	0.08	0.05	0.09	0.11	0.07	0.02	0.04	0.04	0.02
20			0.06	0.07	0.08	0.06	0.09	0.10	0.08	0.01	0.03	0.03	0.01
21			0.09	0.10	0.11	0.10	0.13	0.15	0.13	0.02	0.04	0.03	0.02
22			0.09	0.10	0.11	0.10	0.13	0.15	0.13	0.02	0.03	0.03	0.02
23			0.16	0.19	0.19	0.17	0.23	0.27	0.24	0.03	0.06	0.05	0.02
24			0.10	0.11	0.11	0.10	0.13	0.15	0.14	0.02	0.03	0.03	0.01
25			0.19	0.22	0.22	0.20	0.25	0.29	0.27	0.06	0.07	0.05	0.03
26			0.09	0.09	0.09	0.08	0.10	0.12	0.11	0.03	0.03	0.02	0.01
27	C		0.25	0.30	0.28	0.27	0.32	0.35	0.37	0.08	0.10	0.08	0.04
28			0.06	0.07	0.06	0.06	0.07	0.07	0.09	0.02	0.03	0.02	0.01
29	C		0.27	0.32	0.29	0.28	0.32	0.34	0.40	0.08	0.11	0.09	0.05
30			0.04	0.04	0.04	0.03	0.04	0.04	0.05	0.02	0.02	0.01	0.01
31	C		0.25	0.30	0.27	0.26	0.29	0.29	0.38	0.06	0.11	0.09	0.05
32			0.02	0.04	0.02	0.02	0.03	0.04	0.03	0.01	0.01	0.01	0.00
33	C		0.09	0.10	0.10	0.09	0.10	0.10	0.13	0.03	0.04	0.03	0.02
34			0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.00
Total			1.94	2.32	2.35	2.04	2.58	2.86	2.85	0.54	0.96	0.71	0.39
Σ assigned to A			0.12	0.17	0.24	0.14	0.22	0.26	0.20	0.04	0.15	0.09	0.05
% assigned to A			6	7	10	7	9	9	7	7	16	13	14
Σ assigned to C			0.85	1.02	0.94	0.90	1.03	1.07	1.28	0.25	0.36	0.29	0.16
% assigned to C			44	44	40	44	40	37	45	46	37	40	41
CPI			4.1	4.2	4.3	4.6	4.4	4.1	4.4	3.6	3.9	4.6	4.5

n-Alkane	assigned group	Station	64/504	64/506	64/508	64/511	64/516	64/526	64/528	64/529	64/531	64/573	64/581
		Zone	ICZ	ICZ	ICZ	ICZ	ICZ	MIZ	ICZ	ICZ	ICZ	CZ	ICZ
15	A		0.04	0.04	0.03	0.02	0.02	0.03	0.07	0.03	0.06	0.06	0.01
16			0.04	0.04	0.03	0.01	0.01	0.03	0.05	0.06	0.05	0.05	0.01
17	A		0.05	0.05	0.04	0.02	0.02	0.05	0.06	0.08	0.06	0.05	0.02
18			0.05	0.04	0.03	0.01	0.02	0.04	0.05	0.07	0.05	0.05	0.01
19	A		0.05	0.05	0.04	0.02	0.03	0.06	0.06	0.08	0.07	0.06	0.02
20			0.05	0.05	0.03	0.01	0.02	0.06	0.06	0.06	0.07	0.04	0.02
21			0.07	0.07	0.05	0.02	0.03	0.09	0.09	0.09	0.10	0.06	0.02
22			0.07	0.07	0.05	0.02	0.03	0.08	0.09	0.09	0.09	0.05	0.02
23			0.11	0.12	0.08	0.03	0.05	0.15	0.15	0.14	0.16	0.09	0.04
24			0.06	0.07	0.05	0.02	0.03	0.08	0.09	0.08	0.09	0.06	0.03
25			0.11	0.15	0.10	0.04	0.06	0.16	0.17	0.16	0.18	0.11	0.05
26			0.05	0.06	0.04	0.02	0.03	0.07	0.07	0.07	0.08	0.05	0.02
27	C		0.14	0.19	0.13	0.07	0.09	0.20	0.21	0.20	0.23	0.14	0.07
28			0.04	0.04	0.03	0.01	0.02	0.04	0.05	0.05	0.06	0.05	0.02
29	C		0.14	0.19	0.15	0.08	0.10	0.19	0.21	0.19	0.23	0.15	0.08
30			0.02	0.03	0.02	0.01	0.02	0.03	0.03	0.03	0.03	0.04	0.01
31	C		0.13	0.18	0.14	0.08	0.10	0.17	0.20	0.19	0.21	0.16	0.08
32			0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.01
33	C		0.04	0.06	0.05	0.03	0.04	0.05	0.07	0.06	0.07	0.06	0.03
34			0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00
Total			1.29	1.52	1.11	0.53	0.73	1.59	1.78	1.74	1.90	1.33	0.58
Σ assigned to A			0.15	0.14	0.11	0.05	0.07	0.14	0.18	0.19	0.19	0.16	0.05
% assigned to A			12	9	10	10	9	9	10	11	10	12	8
Σ assigned to C			0.46	0.62	0.48	0.25	0.33	0.61	0.69	0.64	0.74	0.51	0.26
% assigned to C			36	41	43	47	45	38	39	37	39	38	45
CPI			3.9	4.4	4.5	5.0	4.4	4.2	4.1	4.2	4.1	3.4	4.4

Table 15 (continued)

n-Alkane	assigned group	Station	64/582	64/583	64/584	64/585	64/586	64/628	64/706	64/707	64/708	64/710
		Zone	ICZ	ICZ		ICZ	ICZ	MIZ	SOWZ	MIZ	MIZ	MIZ
15	A		0.02	0.04	0.03	0.11	0.01	0.06	0.10	0.02	0.03	0.04
16			0.02	0.03	0.04	0.08	0.01	0.07	0.04	0.02	0.04	0.05
17	A		0.02	0.04	0.04	0.09	0.03	0.10	0.04	0.03	0.05	0.06
18			0.02	0.03	0.04	0.06	0.03	0.08	0.03	0.03	0.05	0.05
19	A		0.02	0.04	0.05	0.07	0.05	0.11	0.04	0.04	0.06	0.07
20			0.02	0.04	0.04	0.06	0.05	0.11	0.04	0.04	0.06	0.08
21			0.03	0.06	0.06	0.09	0.09	0.17	0.05	0.05	0.10	0.12
22			0.03	0.05	0.06	0.09	0.09	0.16	0.05	0.05	0.09	0.12
23			0.05	0.10	0.11	0.15	0.16	0.29	0.09	0.09	0.17	0.21
24			0.03	0.05	0.06	0.09	0.09	0.16	0.05	0.06	0.10	0.12
25			0.06	0.11	0.13	0.17	0.17	0.31	0.10	0.11	0.19	0.25
26			0.02	0.05	0.05	0.07	0.07	0.13	0.04	0.04	0.08	0.10
27	C		0.07	0.15	0.17	0.22	0.22	0.41	0.12	0.15	0.24	0.32
28			0.02	0.03	0.04	0.05	0.05	0.09	0.03	0.03	0.06	0.08
29	C		0.08	0.16	0.20	0.23	0.22	0.42	0.14	0.16	0.25	0.33
30			0.01	0.02	0.03	0.03	0.03	0.05	0.02	0.02	0.03	0.04
31	C		0.08	0.15	0.18	0.21	0.20	0.38	0.14	0.15	0.23	0.31
32			0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.02	0.02
33	C		0.03	0.04	0.06	0.07	0.07	0.13	0.05	0.05	0.08	0.10
34			0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.01
Total			0.63	1.20	1.42	1.95	1.65	3.26	1.18	1.17	1.93	2.51
Σ assigned to A			0.06	0.11	0.12	0.26	0.09	0.27	0.18	0.09	0.14	0.18
% assigned to A			9	9	9	13	5	8	15	8	7	7
Σ assigned to C			0.25	0.50	0.62	0.74	0.70	1.34	0.45	0.50	0.81	1.07
% assigned to C			40	41	44	38	43	41	38	43	42	43
CPI			4.2	4.6	4.5	4.6	4.4	4.5	4.5	4.6	4.3	4.3

Table 16 Concentrations (µg/g Sed.) of *n*-alkanes and CPI in sea-ice sediments.

n-Alkane	assigned group	Station	57/01-1	62/01-1	62/02-1	62/03-1	62/04-1	62/05-1	62/05-2	62/06-1	62/07-1
15	A		0.26	0.10	0.12	0.01	0.03	0.23	0.28	0.30	0.17
16			0.03	0.20	0.02	0.30	0.94	0.12	0.02	0.15	0.03
17	A		0.14	0.18	0.07	0.80	4.46	0.19	0.07	1.46	0.10
18			0.11	0.17	0.07	0.45	1.17	0.09	0.07	0.14	0.10
19	A		0.34	0.19	0.25	0.88	2.97	0.23	0.18	0.57	0.27
20			0.26	0.17	0.29	0.95	2.25	0.24	0.19	0.45	0.35
21			0.61	0.22	0.92	1.75	4.50	0.57	0.51	1.33	0.90
22			0.57	0.20	0.89	1.68	3.29	0.50	0.52	1.03	0.82
23			1.45	0.29	2.36	2.86	7.03	1.22	1.30	2.63	1.80
24			0.59	0.17	0.93	1.35	2.26	0.51	0.54	0.92	0.76
25			1.37	0.30	2.55	2.57	3.94	1.18	1.41	2.25	1.78
26			0.49	0.15	0.82	0.96	1.54	0.46	0.45	0.75	0.54
27	C		1.65	0.32	3.02	2.49	3.53	1.57	1.77	3.00	1.91
28			0.31	0.08	0.47	0.52	0.79	0.35	0.25	0.58	0.36
29	C		1.03	0.20	1.87	1.76	2.13	1.41	1.08	2.66	1.40
30			0.11	0.06	0.24	0.28	0.45	0.22	0.14	0.30	0.20
31	C		0.76	0.10	1.57	1.43	1.54	1.11	0.88	1.93	1.14
32			0.06	0.02	0.11	0.13	0.17	0.10	0.06	0.15	0.08
33	C		0.23	0.07	0.45	0.49	0.44	0.36	0.28	0.63	0.37
34			0.01	0.01	0.03	0.05	0.06	0.04	0.02	0.06	0.03
Total			10.38	3.22	17.04	21.73	43.47	10.70	10.02	21.29	13.10
Σ assigned to A			0.73	0.47	0.44	1.69	7.45	0.65	0.53	2.33	0.54
% assigned to A			7	15	3	8	17	6	5	11	4
Σ assigned to C			3.66	0.69	6.91	6.17	7.64	4.45	4.01	8.22	4.81
% assigned to C			35	21	41	28	18	42	40	39	37
CPI			4.2	2.5	4.7	3.6	3.0	4.1	4.8	4.8	4.4

n-Alkane	assigned group	Station	62/07-2	62/08-1	62/08-2	62/08-3	62/09-1	62/10-1	64/02-1	64/05-1	64/11-1
15	A		0.25	0.23	0.17	0.19	1.05	0.08	0.84	0.34	0.40
16			0.34	0.04	0.04	0.04	0.11	0.02	0.32	0.04	0.07
17	A		1.54	0.36	0.40	0.46	0.38	0.07	1.12	0.14	0.36
18			0.56	0.20	0.21	0.28	0.23	0.08	0.22	0.12	0.42
19	A		1.30	0.51	0.56	0.76	0.50	0.20	0.53	0.31	0.92
20			1.28	0.62	0.70	0.93	0.44	0.24	0.48	0.34	1.02
21			2.48	1.07	1.25	1.60	0.88	0.56	1.09	0.84	1.98
22			2.09	0.86	1.03	1.28	0.83	0.50	0.91	0.78	1.99
23			3.83	1.26	1.54	1.80	1.89	1.10	2.15	1.62	3.93
24			1.56	0.42	0.54	0.59	0.81	0.47	0.81	0.71	1.84
25			2.89	0.74	0.97	0.99	1.82	1.11	1.80	1.62	3.71
26			1.06	0.25	0.42	0.30	0.64	0.37	0.67	0.54	1.43
27	C		3.18	0.65	1.01	0.86	1.96	1.32	1.89	1.77	3.88
28			0.64	0.13	0.31	0.16	0.37	0.28	0.41	0.35	0.71
29	C		2.40	0.39	0.82	0.59	1.25	1.17	1.50	1.42	2.17
30			0.28	0.05	0.20	0.08	0.21	0.15	0.22	0.20	0.39
31	C		1.59	0.33	0.90	0.65	1.01	1.18	1.17	1.17	1.68
32			0.11	0.01	0.11	0.02	0.09	0.02	0.09	0.08	0.15
33	C		0.45	0.07	0.27	0.18	0.33	0.42	0.35	0.39	0.55
34			0.03	0.00	0.05	0.01	0.04	0.02	0.03	0.02	0.06
Total			27.86	8.19	11.51	11.78	14.84	9.39	16.60	12.80	27.68
Σ assigned to A			3.09	1.09	1.13	1.41	1.93	0.36	2.48	0.79	1.69
% assigned to A			11	13	10	12	13	4	15	6	6
Σ assigned to C			7.63	1.45	3.00	2.28	4.54	4.09	4.92	4.74	8.28
% assigned to C			27	18	26	19	31	44	30	37	30
CPI			3.9	3.8	3.1	4.3	3.8	5.1	3.9	4.4	3.5

Table 17 Concentrations (µg/g Sed.) of Fatty Acids and Fatty Acid-Ratios in marine sediments.

Fatty Acid	assigned group	Station	2616	2618	2619	2620	2622	2623	2624	2625	2626	2627	2628
		Zone	MIZ	CZ	CZ	CZ	CZ	CZ				MIZ	MIZ
n-Saturates													
14	A		0.61	1.17	2.73	1.80	0.81	0.74	0.86	18.26	0.37	0.61	0.61
15	B		0.14	0.14	0.20	0.14	0.12	0.11	0.12	1.20	0.05	0.12	0.15
16			1.99	4.21	8.39	4.97	2.99	2.89	3.02	36.68	1.44	2.33	2.41
17	B		0.07	0.06	0.09	0.07	0.08	0.07	0.07	0.10	0.04	0.07	0.08
18			0.45	0.39	0.63	0.40	0.65	0.38	0.20	1.03	0.20	0.36	0.44
20			0.21	0.11	0.18	0.09	0.12	0.18	0.11	0.14	0.05	0.24	0.24
21			0.06	0.04	0.03	0.02	0.03	0.04	0.04	0.21	0.01	0.07	0.07
22			0.34	0.15	0.21	0.12	0.14	0.29	0.16	0.18	0.07	0.37	0.38
23			0.17	0.05	0.05	0.03	0.04	0.09	0.06	0.18	0.02	0.18	0.19
24	C		0.73	0.31	0.33	0.27	0.23	0.51	0.34	0.39	0.12	0.74	0.77
25			0.24	0.10	0.07	0.12	0.05	0.12	0.08	0.06	0.02	0.25	0.26
26	C		0.83	0.33	0.33	0.27	0.20	0.54	0.37	0.34	0.10	0.83	0.88
27			0.24	0.08	0.06	0.08	0.04	0.11	0.08	0.03	0.01	0.23	0.25
28	C		0.60	0.24	0.23	0.16	0.15	0.42	0.27	0.17	0.06	0.68	0.63
29			0.12	0.05	0.03	0.04	0.00	0.07	0.05	0.02	0.01	0.12	0.13
30	C		0.21	0.07	0.08	0.06	0.00	0.22	0.10	0.06	0.02	0.20	0.23
32	C		0.10	0.02	0.03	0.00	0.04	0.07	0.05	0.00	0.01	0.10	0.13
Monounsaturates													
16:1*n*-7	A		1.79	5.64	16.57	10.91	3.74	2.96	4.05	0.00	0.76	1.52	1.62
16:1*n*-5	A		0.32	0.40	0.42	0.33	0.19	0.33	0.31	103.62	0.09	0.27	0.30
18:1*n*-9	B		0.75	2.61	2.68	1.40	0.87	0.80	0.77	5.05	1.08	0.78	0.84
18:1*n*-7	B		1.13	1.54	2.50	1.09	0.77	0.95	0.93	3.38	0.30	1.07	0.91
20:1*n*-9	B		0.16	0.37	0.32	0.09	0.08	0.17	0.11	0.21	0.08	0.12	0.25
20:1*n*-7	B		0.07	0.12	0.23	0.06	0.08	0.07	0.07	0.42	0.05	0.20	0.11
22:1[1]	B		0.12	0.22	0.37	0.16	0.10	0.19	0.13	0.96	0.05	0.18	0.31
Polyunsaturates													
18:2			0.15	0.59	0.91	0.41	0.20	0.21	0.21	2.18	0.30	0.24	0.26
18:3			0.01	0.06	0.21	0.10	0.07	0.03	0.03	1.51	0.02	0.01	0.01
18:4*n*-3	A		0.09	0.18	0.33	0.24	0.14	0.10	0.10	3.83	0.07	0.10	0.08
20:2			0.05	0.34	0.18	0.06	0.15	0.05	0.04	0.29	0.05	0.16	0.08
20:4*n*-6	A		0.17	0.84	0.86	0.29	0.35	0.18	0.14	0.00	0.06	0.31	0.28
20:5*n*-3	A		0.25	0.64	2.64	1.35	0.76	0.45	0.45	37.15	0.28	0.21	0.25
22:6*n*-3	A		0.16	0.25	0.68	0.21	0.20	0.13	0.12	2.39	0.21	0.15	0.15
Branched													
i-15	B		0.32	0.39	0.40	0.33	0.22	0.35	0.32	0.29	0.10	0.26	0.29
ai-15	B		0.39	0.44	0.39	0.31	0.24	0.39	0.34	0.38	0.11	0.29	0.36
i-17	B		0.14	0.14	0.15	0.09	0.07	0.09	0.09	0.13	0.03	0.12	0.11
ai-17	B		0.14	0.11	0.11	0.08	0.07	0.08	0.08	0.14	0.04	0.11	0.12
Total			13.33	22.42	43.59	26.15	13.94	14.40	14.26	221.00	6.30	13.60	14.19
Σ assigned to A			3.41	9.12	24.23	15.13	6.17	4.90	6.01	165.25	1.84	3.16	3.29
% assigned to A			26	41	56	58	44	34	42	75	29	23	23
Σ assigned to B			3.42	6.15	7.42	3.84	2.68	3.28	3.03	12.28	1.94	3.34	3.53
% assigned to B			26	27	17	15	19	23	21	6	31	25	25
Σ assigned to C			2.47	0.98	1.00	0.75	0.62	1.75	1.13	0.96	0.31	2.55	2.63
% assigned to C			19	4	2	3	4	12	8	0	5	19	19
16:1/16:0			1.1	1.4	2.0	2.3	1.3	1.1	1.4	2.8	0.6	0.8	0.8
18:1/18:0			4.2	10.5	8.3	6.2	2.5	4.7	8.5	8.2	6.8	5.1	3.9

[1] 22:1*n*-11+22:1*n*-9

Table 17 (continued)

Fatty Acid	assigned group	Station / Zone	2629 MIZ	2630 ICZ	2631 CZ	2632 CZ	2633 CZ	2634 CZ	2635	2636	2637 CZ	2638 CZ	2640 CZ
n-Saturates													
14	A		0.61	0.46	1.43	1.34	0.84	1.61	3.32	26.13	0.64	1.82	2.76
15	B		0.13	0.08	0.14	0.10	0.08	0.13	0.18	2.21	0.14	0.18	0.17
16			2.46	1.97	4.28	3.38	2.80	5.78	9.72	81.02	2.37	5.34	6.93
17	B		0.08	0.05	0.08	0.04	0.04	0.05	0.08	1.06	0.08	0.08	0.07
18			0.38	0.29	0.37	0.26	0.27	0.46	0.68	6.36	0.43	0.45	0.44
20			0.20	0.07	0.12	0.05	0.05	0.11	0.16	1.35	0.19	0.13	0.18
21			0.05	0.02	0.03	0.01	0.01	0.01	0.03	0.23	0.07	0.02	0.04
22			0.29	0.11	0.17	0.07	0.08	0.13	0.21	1.82	0.32	0.20	0.26
23			0.13	0.04	0.05	0.06	0.01	0.03	0.05	0.35	0.17	0.07	0.09
24	C		0.60	0.23	0.36	0.18	0.11	0.24	0.33	2.81	0.76	0.43	0.38
25			0.19	0.05	0.08	0.04	0.02	0.05	0.07	0.62	0.27	0.09	0.09
26	C		0.69	0.25	0.40	0.23	0.11	0.22	0.29	2.72	0.89	0.51	0.27
27			0.17	0.05	0.08	0.04	0.02	0.04	0.05	0.47	0.26	0.09	0.06
28	C		0.49	0.17	0.30	0.21	0.08	0.14	0.20	1.68	0.65	0.35	0.20
29			0.09	0.03	0.05	0.04	0.02	0.02	0.03	0.30	0.13	0.06	0.03
30	C		0.17	0.05	0.13	0.14	0.05	0.07	0.06	0.57	0.24	0.09	0.09
32	C		0.09	0.02	0.04	0.05	0.02	0.02	0.02	0.19	0.12	0.04	0.03
Monounsaturates													
16:1*n*-7	A		1.84	2.14	7.15	5.29	4.27	10.77	24.66	209.41	1.64	8.25	14.73
16:1*n*-5	A		0.30	0.25	0.33	0.10	0.17	0.34	0.42	5.49	0.30	0.47	0.28
18:1*n*-9	B		0.73	0.84	1.30	1.10	1.68	3.69	3.65	34.23	0.65	1.80	2.98
18:1*n*-7	B		0.94	0.95	1.16	0.41	1.03	1.46	2.43	31.90	0.90	1.67	1.07
20:1*n*-9	B		0.22	0.17	0.12	0.11	0.13	0.22	0.23	2.61	0.12	0.14	0.19
20:1*n*-7	B		0.11	0.06	0.09	0.07	0.06	0.15	0.54	2.71	0.10	0.10	0.14
22:1[1]	B		0.20	0.25	0.14	0.21	0.13	0.18	0.24	2.20	0.13	0.22	0.21
Polyunsaturates													
18:2			0.20	0.22	0.38	0.25	0.52	0.80	0.79	10.78	0.20	0.58	0.88
18:3			0.01	0.02	0.06	0.03	0.05	0.00	0.13	1.69	0.01	0.09	0.01
18:4*n*-3	A		0.08	0.10	0.19	0.06	0.14	0.19	0.63	4.75	0.09	0.24	0.14
20:2			0.09	0.08	0.07	0.03	0.15	0.16	0.18	2.34	0.06	0.07	0.10
20:4*n*-6	A		0.27	0.24	0.21	0.04	0.47	0.57	0.27	10.41	0.19	0.37	0.28
20:5*n*-3	A		0.27	0.55	0.98	0.30	0.59	1.47	3.66	27.90	0.23	1.20	1.37
22:6*n*-3	A		0.14	0.25	0.32	0.12	0.24	0.61	0.64	8.72	0.10	0.27	0.49
Branched													
i-15	B		0.33	0.20	0.32	0.14	0.17	0.30	0.34	4.48	0.32	0.48	0.25
ai-15	B		0.36	0.20	0.35	0.14	0.18	0.33	0.39	4.64	0.34	0.47	0.25
i-17	B		0.11	0.10	0.11	0.05	0.08	0.12	0.11	1.39	0.10	0.15	0.11
ai-17	B		0.10	0.07	0.09	0.04	0.05	0.07	0.11	1.38	0.11	0.13	0.09
Total			13.13	10.64	21.49	14.74	14.72	30.55	54.89	496.93	13.32	26.62	35.70
Σ assigned to A			3.52	3.99	10.62	7.25	6.71	15.58	33.59	292.80	3.19	12.61	20.07
% assigned to A			27	37	49	49	46	51	61	59	24	47	56
Σ assigned to B			3.30	2.97	3.89	2.41	3.63	6.71	8.31	88.81	2.98	5.41	5.53
% assigned to B			25	28	18	16	25	22	15	18	22	20	15
Σ assigned to C			2.04	0.73	1.22	0.81	0.37	0.67	0.89	7.98	2.66	1.43	0.97
% assigned to C			16	7	6	5	3	2	2	2	20	5	3
16:1/16:0			0.9	1.2	1.7	1.6	1.6	1.9	2.6	2.7	0.8	1.6	2.2
18:1/18:0			4.4	6.1	6.6	5.7	9.9	11.1	9.0	10.4	3.6	7.8	9.2

[1] 22:1*n*-11+22:1*n*-9

Table 17 (continued)

Fatty Acid	assigned group	Station	2641	2642	2643	2644	2645	2646	2647	2648	2651	2654	2656
		Zone		CZ	CZ		SOWS	SOWS	SOWS	CZ	CZ	CZ	SOWS
n-Saturates													
14	A		n.d.	0.70	0.59	1.59	1.22	0.65	0.65	1.99	0.40	0.22	0.41
15	B		n.d.	0.06	0.06	0.24	0.24	0.13	0.13	0.10	0.04	0.04	0.11
16			n.d.	2.09	1.99	4.86	4.37	2.54	2.48	3.03	1.56	0.70	1.44
17	B		n.d.	0.02	0.04	0.13	0.12	0.06	0.07	0.02	0.03	0.02	0.05
18			n.d.	0.22	0.24	0.72	0.72	0.39	0.35	0.20	0.52	0.12	0.34
20			n.d.	0.04	0.07	0.21	0.20	0.12	0.14	0.03	0.07	0.04	0.13
21			n.d.	0.01	0.01	0.06	0.06	0.04	0.05	0.04	0.02	0.01	0.05
22			n.d.	0.04	0.09	0.41	0.36	0.22	0.24	0.03	0.09	0.05	0.26
23			n.d.	0.01	0.04	0.43	0.20	0.12	0.12	0.45	0.03	0.02	0.10
24	C		n.d.	0.10	0.16	0.99	0.86	0.56	0.57	0.05	0.15	0.10	0.64
25			n.d.	0.02	0.04	0.26	0.29	0.18	0.18	0.01	0.03	0.01	0.12
26	C		n.d.	0.07	0.14	1.07	1.04	0.69	0.75	0.04	0.11	0.06	0.70
27			n.d.	0.02	0.02	0.22	0.26	0.18	0.17	0.02	0.02	0.01	0.14
28	C		n.d.	0.05	0.09	0.67	0.70	0.49	0.47	0.00	0.08	0.04	0.44
29			n.d.	0.01	0.01	0.11	0.14	0.09	0.09	0.00	0.01	0.01	0.07
30	C		n.d.	0.02	0.02	0.22	0.23	0.17	0.16	0.00	0.02	0.01	0.12
32	C		n.d.	0.00	0.01	0.10	0.12	0.09	0.08	0.00	0.01	0.01	0.00
Monounsaturates													
16:1*n*-7	A		n.d.	2.71	0.22	5.33	3.82	2.20	2.34	7.96	0.95	0.40	1.40
16:1*n*-5	A		n.d.	0.06	0.14	1.00	0.72	0.47	0.42	0.12	0.06	0.04	0.40
18:1*n*-9	B		n.d.	0.96	1.01	1.94	1.43	1.06	1.04	1.03	0.82	0.25	0.60
18:1*n*-7	B		n.d.	0.43	0.59	3.33	2.52	1.89	1.42	0.96	0.19	0.09	1.19
20:1*n*-9	B		n.d.	0.06	0.11	0.16	0.28	0.26	0.31	0.66	0.05	0.02	0.10
20:1*n*-7	B		n.d.	0.04	0.06	0.04	0.13	0.13	0.11	0.09	0.02	0.01	0.04
22:1[1]	B		n.d.	0.06	0.10	0.39	0.24	0.21	0.32	0.99	0.09	0.03	0.16
Polyunsaturates													
18:2			n.d.	0.29	0.25	0.35	0.40	0.29	0.26	0.22	0.20	0.08	0.05
18:3			n.d.	0.02	0.03	0.08	0.04	0.02	0.02	0.05	0.02	0.01	0.00
18:4*n*-3	A		n.d.	0.06	0.10	0.35	0.23	0.15	0.11	0.30	0.05	0.03	0.09
20:2			n.d.	0.03	0.03	0.48	0.32	0.45	0.16	0.00	0.02	0.01	0.05
20:4*n*-6	A		n.d.	0.13	0.14	1.06	0.92	0.95	0.47	0.42	0.05	0.01	0.07
20:5*n*-3	A		n.d.	0.30	0.35	2.53	1.11	0.91	0.49	0.11	0.08	0.06	0.07
22:6*n*-3	A		n.d.	0.11	0.15	1.31	0.59	0.59	0.25	0.49	0.07	0.04	0.05
Branched													
i-15	B		n.d.	0.09	0.15	0.73	0.61	0.40	0.37	0.12	0.11	0.07	0.27
ai-15	B		n.d.	0.09	0.13	0.88	0.75	0.48	0.42	0.06	0.10	0.08	0.46
i-17	B		n.d.	0.04	0.08	0.33	0.31	0.23	0.17	0.04	0.03	0.02	0.10
ai-17	B		n.d.	0.03	0.05	0.23	0.26	0.18	0.14	0.03	0.04	0.02	0.11
Total			n.d.	9.00	7.32	32.80	25.81	17.58	15.54	19.68	6.13	2.72	10.34
Σ assigned to A			n.d.	4.07	1.68	13.16	8.60	5.91	4.73	11.40	1.67	0.79	2.51
% assigned to A			n.d.	45	23	40	33	34	30	58	27	29	24
Σ assigned to B			n.d.	1.89	2.39	8.40	6.90	5.03	4.51	4.11	1.51	0.65	3.19
% assigned to B			n.d.	21	33	26	27	29	29	21	25	24	31
Σ assigned to C			n.d.	0.23	0.41	3.05	2.95	2.01	2.03	0.09	0.36	0.22	1.90
% assigned to C			n.d.	3	6	9	11	11	13	0	6	8	18
16:1/16:0			n.d.	1.3	0.2	1.3	1.0	1.0	1.1	2.7	0.7	0.6	1.2
18:1/18:0			n.d.	6.2	6.6	7.3	5.5	7.5	7.1	10.1	1.9	2.9	5.3

[1] 22:1*n*-11+22:1*n*-9

Table 17 (continued)

Fatty Acid	assigned group	Station	57/066	57/067	57/068	57/069	57/070	57/075	57/076	57/077	57/080	57/082	57/083
		Zone	ICZ	ICZ		ICZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
n-Saturates													
14	A		0.58	0.25	n.d.	0.47	0.73	0.73	0.63	0.66	0.64	0.72	0.60
15	B		0.12	0.06	n.d.	0.10	0.17	0.14	0.14	0.14	0.14	0.16	0.13
16			2.67	1.02	n.d.	1.65	2.64	2.32	2.42	2.62	2.23	2.65	2.09
17	B		0.06	0.05	n.d.	0.07	0.09	0.08	0.08	0.08	0.08	0.09	0.07
18			0.36	0.25	n.d.	0.29	0.50	0.52	0.77	0.81	0.44	0.53	0.38
20			0.11	0.11	n.d.	0.13	0.31	0.26	0.35	0.41	0.24	0.34	0.20
21			0.02	0.04	n.d.	0.05	0.11	0.08	0.10	0.11	0.09	0.11	0.08
22			0.14	0.16	n.d.	0.22	0.54	0.40	0.56	0.71	0.40	0.54	0.37
23			0.04	0.09	n.d.	0.12	0.29	0.21	0.25	0.32	0.21	0.26	0.24
24	C		0.25	0.34	n.d.	0.50	1.18	0.92	1.08	1.37	0.90	1.06	0.92
25			0.07	0.11	n.d.	0.17	0.40	0.30	0.37	0.44	0.31	0.03	0.32
26	C		0.29	0.38	n.d.	0.54	1.27	0.98	1.11	1.38	1.00	1.08	0.97
27			0.05	0.11	n.d.	0.14	0.37	0.27	0.32	0.39	0.28	0.31	0.28
28	C		0.21	0.27	n.d.	0.39	1.13	0.69	0.97	1.26	0.72	0.80	0.69
29			0.03	0.06	n.d.	0.07	0.19	0.14	0.17	0.19	0.15	0.16	0.14
30	C		0.06	0.08	n.d.	0.13	0.33	0.23	0.30	0.36	0.26	0.29	0.24
32	C		0.00	0.04	n.d.	0.06	0.17	0.11	0.16	0.18	0.13	0.15	0.12
Monounsaturates													
16:1*n*-7	A		2.95	0.65	n.d.	1.52	1.97	1.62	1.77	1.90	1.61	2.02	1.72
16:1*n*-5	A		0.39	0.11	n.d.	0.22	0.42	0.30	0.34	0.34	0.30	0.34	0.28
18:1*n*-9	B		1.55	0.29	n.d.	0.58	0.79	0.73	0.70	0.71	0.63	0.76	0.62
18:1*n*-7	B		1.45	0.38	n.d.	0.83	1.40	1.08	1.12	1.16	1.02	1.25	0.98
20:1*n*-9	B		0.15	0.08	n.d.	0.08	0.12	0.17	0.11	0.14	0.09	0.14	0.09
20:1*n*-7	B		0.12	0.04	n.d.	0.13	0.12	0.12	0.08	0.10	0.09	0.09	0.07
22:1[1]	B		0.14	0.13	n.d.	0.09	0.12	0.18	0.12	0.15	0.10	0.14	0.11
Polyunsaturates													
18:2			0.49	0.07	n.d.	0.13	0.15	0.13	0.11	0.10	0.13	0.15	0.12
18:3			0.06	0.01	n.d.	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01
18:4*n*-3	A		0.10	0.04	n.d.	0.09	0.12	0.10	0.09	0.10	0.09	0.11	0.10
20:2			0.13	0.04	n.d.	0.07	0.07	0.06	0.07	0.07	0.07	0.12	0.05
20:4*n*-6	A		0.55	0.16	n.d.	0.27	0.34	0.22	0.19	0.24	0.21	0.28	0.23
20:5*n*-3	A		1.05	0.15	n.d.	0.33	0.37	0.49	0.27	0.31	0.29	0.38	0.34
22:6*n*-3	A		0.55	0.09	n.d.	0.13	0.19	0.26	0.13	0.15	0.14	0.17	0.13
Branched													
i-15	B		0.20	0.15	n.d.	0.21	0.36	0.27	0.27	0.28	0.26	0.30	0.24
ai-15	B		0.24	0.15	n.d.	0.25	0.50	0.35	0.40	0.39	0.34	0.38	0.33
i-17	B		0.09	0.06	n.d.	0.09	0.11	0.09	0.09	0.09	0.10	0.13	0.07
ai-17	B		0.08	0.06	n.d.	0.09	0.14	0.12	0.11	0.12	0.11	0.13	0.11
Total			15.36	6.09	n.d.	10.22	17.70	14.67	15.76	17.79	13.79	16.19	13.45
Σ assigned to A			6.17	1.45	n.d.	3.04	4.13	3.72	3.43	3.69	3.27	4.03	3.39
% assigned to A			40	24	n.d.	30	23	25	22	21	24	25	25
Σ assigned to B			4.20	1.44	n.d.	2.51	3.92	3.33	3.22	3.38	2.97	3.57	2.84
% assigned to B			27	24	n.d.	25	22	23	20	19	22	22	21
Σ assigned to C			0.81	1.11	n.d.	1.63	4.07	2.94	3.61	4.56	3.01	3.38	2.94
% assigned to C			5	18	n.d.	16	23	20	23	26	22	21	22
16:1/16:0			1.3	0.7	n.d.	1.1	0.9	0.8	0.9	0.9	0.9	0.9	1.0
18:1/18:0			8.4	2.6	n.d.	4.9	4.4	3.5	2.4	2.3	3.8	3.8	4.2

[1] 22:1*n*-11+22:1*n*-9

Table 17 (continued)

Fatty Acid	assigned group	Station	57/084	57/085	57/087	57/088	57/090	57/091	57/092	57/093	57/094	57/095	57/097
		Zone	MIZ	MIZ	ICZ	MIZ	MIZ		MIZ	MIZ	MIZ	MIZ	MIZ
n-Saturates													
14	A		0.76	0.58	0.47	0.59	0.73	0.69	0.52	0.70	0.75	0.72	0.48
15	B		0.17	0.12	0.10	0.13	0.16	0.14	0.11	0.15	0.14	0.15	0.10
16			2.94	2.31	1.72	2.15	2.67	2.54	1.88	2.58	2.97	2.65	1.83
17	B		0.11	0.09	0.07	0.08	0.07	0.09	0.06	0.09	0.10	0.08	0.06
18			0.87	0.76	0.30	0.42	0.36	0.42	0.34	0.46	0.77	0.43	0.36
20			0.40	0.34	0.17	0.31	0.20	0.28	0.17	0.28	0.37	0.26	0.23
21			0.11	0.10	0.06	0.08	0.09	0.09	0.07	0.08	0.10	0.09	0.08
22			0.62	0.50	0.23	0.49	0.43	0.47	0.31	0.47	0.61	0.48	0.04
23			0.29	0.26	0.14	0.22	0.25	0.24	0.19	0.23	0.29	0.26	0.21
24	C		1.25	1.07	0.59	0.90	0.96	0.95	0.76	0.97	1.17	1.06	0.85
25			0.41	0.35	0.20	0.30	0.31	0.30	0.26	0.33	0.37	0.37	0.29
26	C		1.27	1.11	0.60	0.94	0.97	0.88	0.79	0.99	1.15	1.08	0.88
27			0.36	0.32	0.17	0.28	0.26	0.25	0.22	0.27	0.31	0.28	0.24
28	C		1.01	0.96	0.46	0.81	0.64	0.78	0.53	0.72	0.94	0.76	0.63
29			0.18	0.16	0.11	0.15	0.13	0.12	0.10	0.15	0.15	0.16	0.12
30	C		0.35	0.31	0.15	0.26	0.24	0.23	0.17	0.27	0.28	0.28	0.23
32	C		0.18	0.16	0.06	0.14	0.12	0.11	0.08	0.14	0.14	0.15	0.13
Monounsaturates													
16:1*n*-7	A		2.09	1.34	1.55	1.79	2.70	2.24	1.34	2.16	2.26	2.23	1.29
16:1*n*-5	A		0.41	0.31	0.22	0.26	0.43	0.38	0.24	0.34	0.39	0.36	0.25
18:1*n*-9	B		0.84	0.59	0.57	0.66	1.23	0.83	0.56	0.87	1.03	0.80	0.45
18:1*n*-7	B		1.37	0.91	0.74	0.88	1.65	1.23	0.77	1.27	1.41	1.15	0.79
20:1*n*-9	B		0.16	0.10	0.08	0.13	0.18	0.13	0.11	0.20	0.25	0.12	0.06
20:1*n*-7	B		0.12	0.08	0.13	0.11	0.16	0.15	0.08	0.11	0.15	0.08	0.08
22:1[1]	B		0.20	0.11	0.06	0.14	0.19	0.13	0.14	0.26	0.34	0.12	0.10
Polyunsaturates													
18:2			0.15	0.10	0.12	0.15	0.21	0.21	0.09	0.18	0.19	0.11	0.08
18:3			0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.02	0.02	0.01	0.01
18:4*n*-3	A		0.13	0.08	0.07	0.09	0.18	0.14	0.08	0.14	0.16	0.11	0.06
20:2			0.12	0.03	0.05	0.05	0.15	0.10	0.04	0.09	0.12	0.07	0.05
20:4*n*-6	A		0.30	0.17	0.21	0.22	0.65	0.45	0.19	0.42	0.47	0.32	0.14
20:5*n*-3	A		0.35	0.17	0.26	0.28	0.57	0.47	0.23	0.50	0.64	0.39	0.16
22:6*n*-3	A		0.21	0.09	0.10	0.12	0.30	0.23	0.10	0.25	0.36	0.20	0.07
Branched													
i-15	B		0.35	0.26	0.20	0.23	0.31	0.29	0.24	0.29	0.31	0.31	0.21
ai-15	B		0.48	0.36	0.25	0.30	0.41	0.39	0.29	0.35	0.39	0.40	0.30
i-17	B		0.13	0.09	0.09	0.10	0.11	0.11	0.08	0.11	0.10	0.10	0.07
ai-17	B		0.14	0.11	0.08	0.10	0.11	0.12	0.09	0.12	0.13	0.11	0.07
Total			18.83	14.42	10.40	13.84	18.16	16.21	11.24	16.59	19.34	16.26	11.02
Σ assigned to A			4.25	2.75	2.88	3.35	5.55	4.60	2.71	4.52	5.02	4.33	2.45
% assigned to A			23	19	28	24	31	28	24	27	26	27	22
Σ assigned to B			4.08	2.81	2.36	2.85	4.60	3.61	2.52	3.83	4.34	3.44	2.30
% assigned to B			22	19	23	21	25	22	22	23	22	21	21
Σ assigned to C			4.05	3.61	1.87	3.05	2.92	2.95	2.33	3.09	3.68	3.33	2.72
% assigned to C			21	25	18	22	16	18	21	19	19	20	25
16:1/16:0			0.8	0.7	1.0	1.0	1.2	1.0	0.8	1.0	0.9	1.0	0.8
18:1/18:0			2.6	2.0	4.4	3.6	7.9	4.9	3.9	4.7	3.2	4.5	3.5

[1] 22:1*n*-11+22:1*n*-9

Table 17 (continued)

Fatty Acid	assigned group	Station / Zone	57/098 MIZ	57/100 MIZ	57/101 MIZ	57/102 MIZ	57/104 MIZ	57/105 MIZ	59/064 MIZ	59/066 MIZ	59/068 MIZ	59/070 MIZ	59/072 MIZ
n-Saturates													
14	A		0.51	0.52	0.71	0.81	0.54	0.67	0.54	0.48	0.46	0.65	0.60
15	B		0.12	0.12	0.16	0.19	0.11	0.15	0.13	0.12	0.10	0.16	0.14
16			1.86	1.91	2.66	3.01	2.01	2.53	2.10	1.75	1.72	2.51	2.19
17	B		0.08	0.07	0.09	0.11	0.07	0.10	0.08	0.07	0.06	0.09	0.09
18			0.34	0.42	0.48	0.51	0.43	0.52	0.43	0.35	0.39	0.48	0.45
20			0.23	0.37	0.26	0.37	0.41	0.34	0.33	0.25	0.20	0.39	0.30
21			0.07	0.09	0.08	0.12	0.09	0.09	0.09	0.07	0.07	0.10	0.08
22			0.40	0.57	0.45	0.65	0.60	0.50	0.49	0.39	0.35	0.61	0.46
23			0.22	0.24	0.23	0.33	0.23	0.23	0.22	0.20	0.19	0.25	0.21
24	C		0.89	1.03	0.93	1.38	1.03	0.98	0.94	0.78	0.76	1.09	0.87
25			0.31	0.34	0.29	0.44	0.34	0.32	0.30	0.25	0.26	0.33	0.29
26	C		0.93	1.06	0.92	1.34	1.06	1.03	0.94	0.79	0.80	1.08	0.91
27			0.27	0.31	0.26	0.38	0.31	0.29	0.26	0.22	0.21	0.31	0.26
28	C		0.75	0.85	0.58	1.15	0.89	0.74	0.76	0.64	0.53	1.08	0.79
29			0.13	0.15	0.11	0.18	0.16	0.15	0.13	0.10	0.12	0.17	0.12
30	C		0.24	0.29	0.20	0.34	0.29	0.27	0.24	0.18	0.19	0.30	0.22
32	C		0.12	0.15	0.09	0.17	0.15	0.14	0.12	0.09	0.10	0.14	0.12
Monounsaturates													
16:1*n*-7	A		1.26	1.15	2.41	2.59	1.14	1.92	1.24	1.04	1.14	1.70	1.50
16:1*n*-5	A		0.29	0.24	0.37	0.43	0.23	0.30	0.28	0.24	0.26	0.36	0.30
18:1*n*-9	B		0.47	0.48	0.96	0.97	0.53	0.81	0.61	0.48	0.49	0.82	0.78
18:1*n*-7	B		0.82	0.72	1.41	1.55	0.71	1.17	0.97	0.73	0.79	1.20	0.97
20:1*n*-9	B		0.06	0.07	0.14	0.24	0.09	0.25	0.09	0.07	0.10	0.13	0.14
20:1*n*-7	B		0.07	0.07	0.21	0.17	0.07	0.14	0.12	0.07	0.08	0.11	0.09
22:1[1]	B		0.09	0.10	0.17	0.30	0.13	0.39	0.11	0.09	0.18	0.12	0.13
Polyunsaturates													
18:2			0.08	0.10	0.21	0.20	0.13	0.18	0.14	0.10	0.11	0.18	0.17
18:3			0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01
18:4*n*-3	A		0.08	0.07	0.14	0.16	0.07	0.11	0.09	0.07	0.06	0.11	0.09
20:2			0.03	0.05	0.10	0.10	0.13	0.09	0.10	0.04	0.06	0.09	0.05
20:4*n*-6	A		0.14	0.14	0.47	0.53	0.21	0.29	0.18	0.15	0.15	0.27	0.22
20:5*n*-3	A		0.13	0.14	0.62	0.56	0.16	0.57	0.19	0.15	0.16	0.30	0.30
22:6*n*-3	A		0.09	0.07	0.28	0.38	0.10	0.37	0.13	0.09	0.10	0.17	0.22
Branched													
i-15	B		0.26	0.23	0.28	0.35	0.22	0.31	0.25	0.22	0.24	0.30	0.28
ai-15	B		0.34	0.29	0.35	0.45	0.29	0.33	0.31	0.27	0.28	0.38	0.34
i-17	B		0.08	0.08	0.13	0.15	0.07	0.21	0.08	0.07	0.10	0.13	0.11
ai-17	B		0.08	0.09	0.13	0.22	0.08	0.14	0.11	0.09	0.09	0.12	0.13
Total			11.83	12.57	16.90	20.82	13.06	16.63	13.09	10.69	10.91	16.24	13.94
Σ assigned to A			2.49	2.33	5.00	5.46	2.44	4.23	2.64	2.22	2.33	3.57	3.23
% assigned to A			21	19	30	26	19	25	20	21	21	22	23
Σ assigned to B			2.46	2.31	4.03	4.68	2.37	4.00	2.86	2.27	2.53	3.56	3.20
% assigned to B			21	18	24	22	18	24	22	21	23	22	23
Σ assigned to C			2.93	3.38	2.72	4.37	3.42	3.15	3.01	2.48	2.38	3.68	2.92
% assigned to C			25	27	16	21	26	19	23	23	22	23	21
16:1/16:0			0.8	0.7	1.0	1.0	0.7	0.9	0.7	0.7	0.8	0.8	0.8
18:1/18:0			3.8	2.9	4.9	4.9	2.9	3.8	3.7	3.5	3.3	4.2	3.9

[1] 22:1*n*-11+22:1*n*-9

Table 17 (continued)

Fatty Acid	assigned group	Station	59/074	59/076	59/077	59/079	59/082	59/084	59/085	59/086	62/002	62/004	62/012
		Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ		MIZ	SOWZ	SOWZ	SOWZ
n-Saturates													
14	A		0.89	1.16	0.82	0.46	0.59	0.67	0.62	0.41	0.16	0.29	0.32
15	B		0.20	0.25	0.20	0.11	0.14	0.15	0.15	0.09	0.05	0.08	0.06
16			2.93	3.60	3.28	1.66	2.17	2.42	2.25	1.40	0.57	1.06	1.05
17	B		0.10	0.11	0.11	0.07	0.07	0.10	0.09	0.05	0.03	0.05	0.04
18			0.50	0.58	0.59	0.35	0.44	0.47	0.47	0.31	0.14	0.23	0.20
20			0.31	0.37	0.40	0.24	0.25	0.28	0.28	0.14	0.06	0.12	0.05
21			0.10	0.08	0.11	0.07	0.09	0.08	0.08	0.06	0.02	0.03	0.01
22			0.50	0.61	0.66	0.34	0.40	0.45	0.49	0.28	0.09	0.23	0.05
23			0.25	0.20	0.29	0.17	0.23	0.23	0.22	0.16	0.03	0.07	0.02
24	C		1.02	0.82	1.26	0.71	0.95	0.97	0.92	0.70	0.21	0.55	0.15
25			0.33	0.24	0.40	0.23	0.30	0.32	0.28	0.26	0.04	0.10	0.03
26	C		1.04	0.73	1.29	0.74	1.03	1.02	0.88	0.77	0.23	0.56	0.15
27			0.29	0.20	0.36	0.21	0.29	0.30	0.24	0.21	0.04	0.09	0.02
28	C		0.90	0.66	1.15	0.61	0.74	0.92	0.75	0.54	0.14	0.30	0.08
29			0.12	0.09	0.16	0.11	0.15	0.14	0.11	0.11	0.03	0.05	0.01
30	C		0.24	0.17	0.30	0.19	0.27	0.26	0.21	0.20	0.05	0.08	0.02
32	C		0.12	0.09	0.16	0.10	0.13	0.13	0.10	0.10	0.02	0.04	0.02
Monounsaturates													
16:1*n*-7	A		2.08	2.35	2.36	1.05	1.61	1.79	1.58	1.12	0.45	0.85	0.69
16:1*n*-5	A		0.42	0.53	0.49	0.23	0.35	0.39	0.36	0.23	0.12	0.25	0.14
18:1*n*-9	B		1.31	1.10	1.33	0.52	0.84	0.95	0.72	0.49	0.18	0.42	0.50
18:1*n*-7	B		1.64	1.56	1.93	0.72	1.32	1.38	1.20	0.87	0.40	0.78	0.82
20:1*n*-9	B		0.28	0.13	0.29	0.07	0.14	0.24	0.17	0.09	0.04	0.08	0.20
20:1*n*-7	B		0.16	0.12	0.22	0.05	0.13	0.14	0.10	0.07	0.02	0.04	0.06
22:1[1]	B		0.35	0.10	0.23	0.08	0.14	0.21	0.09	0.09	0.05	0.09	0.21
Polyunsaturates													
18:2			0.31	0.25	0.30	0.11	0.20	0.19	0.19	0.01	0.05	0.07	0.26
18:3			0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.02
18:4*n*-3	A		0.15	0.14	0.14	0.07	0.10	0.12	0.10	0.07	0.03	0.05	0.11
20:2			0.21	0.08	0.25	0.04	0.11	0.14	0.11	0.09	0.04	0.05	0.22
20:4*n*-6	A		0.47	0.24	0.52	0.14	0.28	0.25	0.20	0.14	0.11	0.19	0.39
20:5*n*-3	A		0.50	0.29	0.51	0.20	0.31	0.43	0.47	0.26	0.15	0.19	0.82
22:6*n*-3	A		0.29	0.13	0.26	0.09	0.18	0.19	0.18	0.10	0.11	0.16	0.50
Branched													
i-15	B		0.35	0.53	0.42	0.22	0.27	0.31	0.27	0.21	0.12	0.23	0.12
ai-15	B		0.43	0.70	0.52	0.28	0.39	0.42	0.37	0.26	0.14	0.27	0.12
i-17	B		0.17	0.15	0.19	0.08	0.14	0.12	0.10	0.08	0.04	0.07	0.13
ai-17	B		0.18	0.17	0.22	0.09	0.13	0.14	0.12	0.09	0.05	0.08	0.06
Total			19.19	18.55	21.71	10.42	14.88	16.30	14.48	10.08	3.99	7.80	7.67
Σ assigned to A			4.80	4.83	5.10	2.25	3.41	3.83	3.51	2.34	1.15	1.99	2.97
% assigned to A			25	26	24	22	23	24	24	23	29	25	39
Σ assigned to B			5.18	4.94	5.65	2.30	3.72	4.16	3.37	2.40	1.11	2.18	2.34
% assigned to B			27	27	26	22	25	26	23	24	28	28	30
Σ assigned to C			3.32	2.47	4.16	2.34	3.11	3.30	2.86	2.31	0.64	1.54	0.42
% assigned to C			17	13	19	22	21	20	20	23	16	20	6
16:1/16:0			0.9	0.8	0.9	0.8	0.9	0.9	0.9	1.0	1.0	1.0	0.8
18:1/18:0			5.9	4.6	5.5	3.5	4.9	5.0	4.1	4.3	4.2	5.2	6.7

[1] 22:1*n*-11+22:1*n*-9

Table 17 (continued)

Fatty Acid	assigned group	Station	62/015	62/017	62/020	62/021	62/026	62/027	62/028	62/029	62/035	62/038	62/041
		Zone	SOWZ	SOWZ	SOWZ	SOWZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
n-Saturates													
14	A		0.92	1.41	0.57	0.66	0.53	0.50	0.45	0.47	0.43	0.18	0.47
15	B		0.14	0.18	0.12	0.15	0.13	0.12	0.12	0.11	0.12	0.04	0.12
16			3.60	4.87	2.23	2.59	1.96	1.65	1.77	1.72	1.48	0.63	1.66
17	B		0.08	0.11	0.08	0.09	0.09	0.06	0.08	0.07	0.07	0.03	0.07
18			0.41	0.51	0.34	0.43	0.42	0.37	0.43	0.40	0.37	0.16	0.40
20			0.14	0.20	0.25	0.33	0.23	0.19	0.30	0.23	0.20	0.08	0.25
21			0.03	0.04	0.06	0.07	0.08	0.07	0.07	0.07	0.06	0.03	0.07
22			0.24	0.34	0.37	0.50	0.39	0.33	0.45	0.36	0.30	0.12	0.38
23			0.09	0.10	0.15	0.18	0.20	0.17	0.19	0.18	0.16	0.06	0.16
24	C		0.52	0.60	0.69	0.85	0.88	0.76	0.88	0.76	0.65	0.24	0.70
25			0.11	0.16	0.23	0.27	0.30	0.23	0.28	0.24	0.23	0.08	0.22
26	C		0.54	0.63	0.78	0.92	0.96	0.70	0.94	0.81	0.78	0.26	0.78
27			0.10	0.12	0.20	0.25	0.27	0.19	0.27	0.24	0.23	0.07	0.23
28	C		0.37	0.53	0.59	0.68	0.74	0.43	0.73	0.64	0.70	0.19	0.70
29			0.05	0.05	0.10	0.12	0.14	0.07	0.14	0.11	0.12	0.03	0.11
30	C		0.11	0.14	0.18	0.22	0.24	0.13	0.24	0.19	0.21	0.06	0.19
32	C		0.04	0.06	0.10	0.10	0.12	0.07	0.12	0.10	0.11	0.03	0.10
Monounsaturates													
16:1*n*-7	A		2.72	7.33	1.43	1.46	1.35	1.20	1.25	1.24	1.32	0.29	1.40
16:1*n*-5	A		0.50	0.47	0.31	0.38	0.33	0.31	0.34	0.32	0.32	0.08	0.33
18:1*n*-9	B		1.04	1.44	0.82	0.85	0.70	0.58	0.72	0.58	0.70	0.17	0.70
18:1*n*-7	B		1.69	3.77	0.96	1.20	1.18	0.92	1.09	0.92	1.01	0.26	1.10
20:1*n*-9	B		0.29	0.32	0.23	0.16	0.16	0.15	0.14	0.12	0.22	0.03	0.15
20:1*n*-7	B		0.08	0.27	0.07	0.10	0.09	0.05	0.07	0.06	0.08	0.01	0.06
22:1[1]	B		0.37	0.34	0.29	0.18	0.17	0.15	0.09	0.10	0.21	0.03	0.15
Polyunsaturates													
18:2			0.31	0.53	0.25	0.30	0.15	0.08	0.13	0.09	0.12	0.02	0.12
18:3			0.03	0.10	0.03	0.02	0.01	0.01	0.01	0.00	0.01	0.00	0.01
18:4*n*-3	A		0.15	0.21	0.10	0.10	0.10	0.08	0.10	0.09	0.10	0.02	0.10
20:2			0.09	0.63	0.09	0.18	0.12	0.07	0.08	0.04	0.10	0.02	0.17
20:4*n*-6	A		0.44	1.73	0.28	0.51	0.31	0.18	0.23	0.16	0.20	0.02	0.21
20:5*n*-3	A		0.84	2.45	0.33	0.33	0.38	0.23	0.29	0.26	0.29	0.01	0.33
22:6*n*-3	A		0.32	0.73	0.22	0.23	0.25	0.19	0.21	0.16	0.27	0.01	0.21
Branched													
i-15	B		0.38	0.34	0.31	0.40	0.30	0.30	0.28	0.27	0.27	0.11	0.27
ai-15	B		0.42	0.40	0.33	0.43	0.36	0.36	0.36	0.37	0.37	0.14	0.38
i-17	B		0.12	0.20	0.08	0.13	0.11	0.11	0.10	0.09	0.12	0.03	0.10
ai-17	B		0.10	0.19	0.10	0.14	0.11	0.11	0.12	0.10	0.13	0.05	0.12
Total			17.40	31.48	13.26	15.50	13.87	11.10	13.02	11.70	12.02	3.56	12.51
Σ assigned to A			5.89	14.34	3.24	3.67	3.25	2.69	2.86	2.71	2.92	0.61	3.05
% assigned to A			34	46	24	24	23	24	22	23	24	17	24
Σ assigned to B			4.71	7.55	3.38	3.83	3.39	2.91	3.14	2.80	3.30	0.89	3.21
% assigned to B			27	24	25	25	24	26	24	24	27	25	26
Σ assigned to C			1.59	1.95	2.34	2.77	2.95	2.09	2.90	2.50	2.44	0.77	2.47
% assigned to C			9	6	18	18	21	19	22	21	20	22	20
16:1/16:0			0.9	1.6	0.8	0.7	0.9	0.9	0.9	0.9	1.1	0.6	1.0
18:1/18:0			6.6	10.1	5.3	4.8	4.4	4.0	4.1	3.7	4.7	2.7	4.5

[1] 22:1*n*-11+22:1*n*-9

Table 17 (continued)

Fatty Acid	assigned group	Station	62/015	62/017	62/020	62/021	62/026	62/027	62/028	62/029	62/035	62/038	62/041
		Zone	SOWZ	SOWZ	SOWZ	SOWZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
n-Saturates													
14	A		0.92	1.41	0.57	0.66	0.53	0.50	0.45	0.47	0.43	0.18	0.47
15	B		0.14	0.18	0.12	0.15	0.13	0.12	0.12	0.11	0.12	0.04	0.12
16			3.60	4.87	2.23	2.59	1.96	1.65	1.77	1.72	1.48	0.63	1.66
17	B		0.08	0.11	0.08	0.09	0.09	0.06	0.08	0.07	0.07	0.03	0.07
18			0.41	0.51	0.34	0.43	0.42	0.37	0.43	0.40	0.37	0.16	0.40
20			0.14	0.20	0.25	0.33	0.23	0.19	0.30	0.23	0.20	0.08	0.25
21			0.03	0.04	0.06	0.07	0.08	0.07	0.07	0.07	0.06	0.03	0.07
22			0.24	0.34	0.37	0.50	0.39	0.33	0.45	0.36	0.30	0.12	0.38
23			0.09	0.10	0.15	0.18	0.20	0.17	0.19	0.18	0.16	0.06	0.16
24	C		0.52	0.60	0.69	0.85	0.88	0.76	0.88	0.76	0.65	0.24	0.70
25			0.11	0.16	0.23	0.27	0.30	0.23	0.28	0.24	0.23	0.08	0.22
26	C		0.54	0.63	0.78	0.92	0.96	0.70	0.94	0.81	0.78	0.26	0.78
27			0.10	0.12	0.20	0.25	0.27	0.19	0.27	0.24	0.23	0.07	0.23
28	C		0.37	0.53	0.59	0.68	0.74	0.43	0.73	0.64	0.70	0.19	0.70
29			0.05	0.05	0.10	0.12	0.14	0.07	0.14	0.11	0.12	0.03	0.11
30	C		0.11	0.14	0.18	0.22	0.24	0.13	0.24	0.19	0.21	0.06	0.19
32	C		0.04	0.06	0.10	0.10	0.12	0.07	0.12	0.10	0.11	0.03	0.10
Monounsaturates													
16:1*n*-7	A		2.72	7.33	1.43	1.46	1.35	1.20	1.25	1.24	1.32	0.29	1.40
16:1*n*-5	A		0.50	0.47	0.31	0.38	0.33	0.31	0.34	0.32	0.32	0.08	0.33
18:1*n*-9	B		1.04	1.44	0.82	0.85	0.70	0.58	0.72	0.58	0.70	0.17	0.70
18:1*n*-7	B		1.69	3.77	0.96	1.20	1.18	0.92	1.09	0.92	1.01	0.26	1.10
20:1*n*-9	B		0.29	0.32	0.23	0.16	0.16	0.15	0.14	0.12	0.22	0.03	0.15
20:1*n*-7	B		0.08	0.27	0.07	0.10	0.09	0.05	0.07	0.06	0.08	0.01	0.06
22:1[1]	B		0.37	0.34	0.29	0.18	0.17	0.15	0.09	0.10	0.21	0.03	0.15
Polyunsaturates													
18:2			0.31	0.53	0.25	0.30	0.15	0.08	0.13	0.09	0.12	0.02	0.12
18:3			0.03	0.10	0.03	0.02	0.01	0.01	0.01	0.00	0.01	0.00	0.01
18:4*n*-3	A		0.15	0.21	0.10	0.10	0.10	0.08	0.10	0.09	0.10	0.02	0.10
20:2			0.09	0.63	0.09	0.18	0.12	0.07	0.08	0.04	0.10	0.02	0.17
20:4*n*-6	A		0.44	1.73	0.28	0.51	0.31	0.18	0.23	0.16	0.20	0.02	0.21
20:5*n*-3	A		0.84	2.45	0.33	0.33	0.38	0.23	0.29	0.26	0.29	0.01	0.33
22:6*n*-3	A		0.32	0.73	0.22	0.23	0.25	0.19	0.21	0.16	0.27	0.01	0.21
Branched													
i-15	B		0.38	0.34	0.31	0.40	0.30	0.30	0.28	0.27	0.27	0.11	0.27
ai-15	B		0.42	0.40	0.33	0.43	0.36	0.36	0.36	0.37	0.37	0.14	0.38
i-17	B		0.12	0.20	0.08	0.13	0.11	0.11	0.10	0.09	0.12	0.03	0.10
ai-17	B		0.10	0.19	0.10	0.14	0.11	0.11	0.12	0.10	0.13	0.05	0.12
Total			17.40	31.48	13.26	15.50	13.87	11.10	13.02	11.70	12.02	3.56	12.51
Σ assigned to A			5.89	14.34	3.24	3.67	3.25	2.69	2.86	2.71	2.92	0.61	3.05
% assigned to A			34	46	24	24	23	24	22	23	24	17	24
Σ assigned to B			4.71	7.55	3.38	3.83	3.39	2.91	3.14	2.80	3.30	0.89	3.21
% assigned to B			27	24	25	25	24	26	24	24	27	25	26
Σ assigned to C			1.59	1.95	2.34	2.77	2.95	2.09	2.90	2.50	2.44	0.77	2.47
% assigned to C			9	6	18	18	21	19	22	21	20	22	20
16:1/16:0			0.9	1.6	0.8	0.7	0.9	0.9	0.9	0.9	1.1	0.6	1.0
18:1/18:0			6.6	10.1	5.3	4.8	4.4	4.0	4.1	3.7	4.7	2.7	4.5

[1] 22:1*n*-11+22:1*n*-9

Table 17 (continued)

Fatty Acid	assigned group	Station	62/044	62/046	62/048	62/050	62/054	62/056	62/058	64/487	64/488	64/489	64/490
		Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	CZ	CZ	ICZ	ICZ
n-Saturates													
14	A		0.53	0.46	0.60	0.48	0.59	0.57	0.54	1.76	1.40	0.44	0.38
15	B		0.14	0.10	0.15	0.12	0.14	0.15	0.13	0.14	0.15	0.08	0.07
16			2.18	1.72	2.16	1.76	2.20	2.09	2.08	4.93	4.29	1.85	1.70
17	B		0.08	0.07	0.10	0.07	0.08	0.08	0.08	0.06	0.07	0.05	0.05
18			0.73	0.42	0.46	0.39	0.46	0.37	0.40	0.38	0.38	0.25	0.23
20			0.28	0.33	0.30	0.23	0.36	0.23	0.28	0.08	0.17	0.12	0.09
21			0.08	0.07	0.08	0.08	0.09	0.09	0.08	0.02	0.03	0.03	0.02
22			0.44	0.46	0.45	0.38	0.57	0.42	0.45	0.10	0.24	0.17	0.15
23			0.20	0.16	0.19	0.19	0.25	0.24	0.22	0.03	0.06	0.05	0.03
24	C		0.91	0.73	0.84	0.79	1.07	1.01	0.94	0.22	0.41	0.32	0.19
25			0.30	0.21	0.26	0.27	0.34	0.34	0.31	0.06	0.08	0.09	0.04
26	C		1.05	0.73	0.86	0.85	1.06	1.01	0.95	0.22	0.44	0.39	0.19
27			0.31	0.22	0.24	0.25	0.30	0.28	0.27	0.05	0.08	0.09	0.04
28	C		0.85	0.57	0.70	0.65	0.77	0.69	0.73	0.18	0.33	0.27	0.13
29			0.15	0.10	0.12	0.12	0.14	0.13	0.14	0.02	0.04	0.05	0.02
30	C		0.27	0.19	0.21	0.21	0.25	0.21	0.24	0.07	0.11	0.09	0.04
32	C		0.14	0.10	0.10	0.11	0.12	0.10	0.13	0.02	0.04	0.05	0.02
Monounsaturates													
16:1*n*-7	A		1.57	1.12	1.59	1.27	1.41	1.49	1.30	10.78	6.91	1.63	1.42
16:1*n*-5	A		0.41	0.24	0.35	0.27	0.33	0.35	0.33	0.28	0.45	0.31	0.23
18:1*n*-9	B		1.22	0.54	0.87	0.60	0.61	0.68	0.58	1.83	1.38	0.85	0.97
18:1*n*-7	B		1.35	0.83	1.36	0.93	1.04	1.16	0.99	2.00	1.44	0.96	0.91
20:1*n*-9	B		0.21	0.11	0.22	0.14	0.11	0.16	0.09	0.24	0.18	0.11	0.17
20:1*n*-7	B		0.12	0.06	0.15	0.05	0.07	0.08	0.07	0.23	0.10	0.06	0.06
22:1[1]	B		0.16	0.11	0.25	0.13	0.15	0.20	0.10	0.26	0.16	0.08	0.23
Polyunsaturates													
18:2			0.21	0.12	0.20	0.13	0.13	0.12	0.12	0.81	0.43	0.30	0.40
18:3			0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.18	0.13	0.04	0.03
18:4*n*-3	A		0.11	0.07	0.11	0.08	0.09	0.10	0.09	0.29	0.23	0.09	0.10
20:2			0.18	0.14	0.28	0.08	0.07	0.08	0.04	0.19	0.08	0.12	0.16
20:4*n*-6	A		0.42	0.27	0.56	0.24	0.24	0.22	0.23	1.45	0.45	0.55	0.40
20:5*n*-3	A		0.42	0.31	0.51	0.36	0.23	0.22	0.22	3.27	1.58	0.58	0.60
22:6*n*-3	A		0.25	0.18	0.27	0.14	0.15	0.17	0.15	0.73	0.40	0.33	0.26
Branched													
i-15	B		0.31	0.02	0.35	0.26	0.31	0.32	0.28	0.24	0.41	0.28	0.22
ai-15	B		0.42	0.29	0.40	0.33	0.40	0.41	0.37	0.22	0.43	0.29	0.20
i-17	B		0.14	0.10	0.16	0.10	0.10	0.12	0.08	0.12	0.12	0.12	0.10
ai-17	B		0.15	0.11	0.16	0.10	0.13	0.12	0.10	0.11	0.11	0.08	0.08
Total			16.29	11.32	15.62	12.19	14.40	14.03	13.13	31.56	23.35	11.14	9.89
Σ assigned to A			3.71	2.66	4.00	2.86	3.04	3.12	2.87	18.56	11.43	3.93	3.39
% assigned to A			23	23	26	23	21	22	22	59	49	35	34
Σ assigned to B			4.31	2.37	4.15	2.83	3.14	3.48	2.87	5.44	4.56	2.96	3.05
% assigned to B			26	21	27	23	22	25	22	17	20	27	31
Σ assigned to C			3.21	2.32	2.72	2.61	3.27	3.01	3.00	0.71	1.34	1.12	0.56
% assigned to C			20	21	17	21	23	21	23	2	6	10	6
16:1/16:0			0.9	0.8	0.9	0.9	0.8	0.9	0.8	2.2	1.7	1.0	1.0
18:1/18:0			3.5	3.3	4.9	3.9	3.6	4.9	3.9	10.1	7.3	7.4	8.1

[1] 22:1*n*-11+22:1*n*-9

Table 17 (continued)

Fatty Acid	assigned group	Station	64/504	64/506	64/508	64/511	64/516	64/526	64/528	64/529	64/531	64/573	64/581
		Zone	ICZ	ICZ	ICZ	ICZ	ICZ	MIZ	ICZ	ICZ	ICZ	CZ	ICZ
n-Saturates													
14	A		0.33	0.27	0.28	0.49	1.68	0.42	0.42	0.35	0.51	3.64	0.37
15	B		0.07	0.07	0.06	0.09	0.21	0.10	0.10	0.08	0.11	0.17	0.06
16			1.38	1.22	1.18	2.41	5.70	1.61	1.57	1.33	1.99	8.91	1.67
17	B		0.04	0.04	0.04	0.06	0.07	0.06	0.05	0.04	0.06	0.09	0.04
18			0.21	0.21	0.19	0.34	0.47	0.34	0.29	0.24	0.33	0.71	0.20
20			0.13	0.16	0.14	0.11	0.13	0.24	0.21	0.16	0.29	0.22	0.09
21			0.03	0.04	0.03	0.02	0.03	0.07	0.06	0.05	0.07	0.05	0.02
22			0.19	0.24	0.20	0.14	0.19	0.35	0.32	0.26	0.41	0.31	0.14
23			0.07	0.12	0.07	0.04	0.06	0.15	0.14	0.13	0.16	0.07	0.04
24	C		0.35	0.48	0.34	0.26	0.34	0.69	0.60	0.56	0.67	0.57	0.24
25			0.11	0.16	0.12	0.07	0.09	0.20	0.19	0.18	0.20	0.13	0.07
26	C		0.37	0.54	0.39	0.30	0.40	0.68	0.59	0.56	0.64	0.61	0.29
27			0.09	0.15	0.10	0.07	0.08	0.18	0.16	0.15	0.17	0.11	0.07
28	C		0.27	0.41	0.27	0.22	0.29	0.49	0.52	0.47	0.47	0.43	0.21
29			0.05	0.07	0.06	0.03	0.05	0.09	0.08	0.07	0.08	0.07	0.04
30	C		0.08	0.14	0.10	0.07	0.10	0.16	0.14	0.15	0.15	0.13	0.07
32	C		0.04	0.07	0.05	0.03	0.04	0.07	0.07	0.07	0.08	0.07	0.04
Monounsaturates													
16:1*n*-7	A		1.25	0.74	0.72	1.90	8.84	1.10	1.18	0.91	1.14	22.60	1.62
16:1*n*-5	A		0.20	0.19	0.15	0.30	0.59	0.25	0.26	0.20	0.26	0.00	0.19
18:1*n*-9	B		0.52	0.51	0.36	1.57	2.25	0.47	0.49	0.33	0.55	1.70	0.84
18:1*n*-7	B		0.66	0.59	0.54	1.55	2.36	0.81	0.83	0.68	0.79	2.18	0.93
20:1*n*-9	B		0.10	0.07	0.07	0.38	0.32	0.10	0.07	0.05	0.07	0.30	0.14
20:1*n*-7	B		0.04	0.06	0.04	0.70	0.10	0.06	0.06	0.06	0.06	0.27	0.08
22:1[1]	B		0.04	0.03	0.04	0.15	0.17	0.06	0.04	0.04	0.05	0.21	0.13
Polyunsaturates													
18:2			0.15	0.13	0.11	0.57	0.66	0.10	0.10	0.07	0.15	1.41	0.35
18:3			0.01	0.01	0.01	0.05	0.16	0.01	0.00	0.00	0.01	0.13	0.03
18:4*n*-3	A		0.06	0.05	0.04	0.16	0.92	0.06	0.06	0.05	0.05	0.73	0.07
20:2			0.08	0.07	0.11	0.49	0.13	0.04	0.05	0.05	0.07	0.21	0.20
20:4*n*-6	A		0.27	0.29	0.35	1.56	0.24	0.21	0.24	0.22	0.23	0.26	0.45
20:5*n*-3	A		0.28	0.13	0.17	1.11	4.73	0.26	0.20	0.16	0.11	6.63	0.53
22:6*n*-3	A		0.12	0.09	0.12	0.63	1.30	0.17	0.13	0.11	0.06	1.03	0.24
Branched													
i-15	B		0.18	0.17	0.17	0.25	0.51	0.20	0.20	0.16	0.25	0.36	0.18
ai-15	B		0.22	0.20	0.19	0.24	0.43	0.28	0.28	0.23	0.32	0.53	0.20
i-17	B		0.07	0.07	0.08	0.14	0.19	0.08	0.09	0.06	0.10	0.19	0.11
ai-17	B		0.06	0.06	0.07	0.10	0.14	0.10	0.09	0.07	0.09	0.15	0.07
Total			8.12	7.83	6.95	16.60	33.98	10.25	9.88	8.30	10.74	55.18	10.04
Σ assigned to A			2.51	1.75	1.83	6.15	18.30	2.46	2.49	1.99	2.36	34.89	3.48
% assigned to A			31	22	26	37	54	24	25	24	22	63	35
Σ assigned to B			2.00	1.87	1.65	5.22	6.76	2.32	2.29	1.80	2.45	6.14	2.77
% assigned to B			25	24	24	31	20	23	23	22	23	11	28
Σ assigned to C			1.12	1.64	1.15	0.89	1.17	2.09	1.93	1.81	2.01	1.81	0.86
% assigned to C			14	21	17	5	3	20	19	22	19	3	9
16:1/16:0			1.0	0.8	0.7	0.9	1.7	0.8	0.9	0.8	0.7	2.5	1.1
18:1/18:0			5.7	5.3	4.8	9.2	9.9	3.7	4.5	4.3	4.0	5.5	8.7

[1] 22:1*n*-11+22:1*n*-9

Table 17 (continued)

Fatty Acid	assigned group	Station / Zone	64/582 ICZ	64/583 ICZ	64/584	64/585 ICZ	64/586 ICZ	64/628 MIZ	64/706 SOWZ	64/707 MIZ	64/708 MIZ	64/710 MIZ
n-Saturates												
14	A		0.28	0.29	0.34	0.49	0.34	0.57	0.31	0.33	0.39	0.43
15	B		0.06	0.06	0.07	0.11	0.08	0.12	0.08	0.07	0.07	0.09
16			1.28	1.22	1.57	1.90	1.33	2.17	1.36	1.23	1.46	1.61
17	B		0.04	0.03	0.03	0.06	0.04	0.07	0.04	0.04	0.04	0.06
18			0.18	0.17	0.18	0.31	0.24	0.39	0.25	0.19	0.19	0.32
20			0.09	0.12	0.14	0.26	0.18	0.27	0.18	0.15	0.13	0.28
21			0.02	0.04	0.05	0.07	0.06	0.09	0.04	0.04	0.03	0.08
22			0.14	0.18	0.23	0.38	0.29	0.46	0.28	0.23	0.19	0.42
23			0.04	0.09	0.10	0.17	0.15	0.23	0.11	0.12	0.09	0.20
24	C		0.23	0.37	0.49	0.71	0.60	0.95	0.47	0.51	0.37	0.86
25			0.06	0.13	0.15	0.23	0.19	0.32	0.14	0.18	0.12	0.30
26	C		0.24	0.42	0.49	0.70	0.58	1.00	0.47	0.60	0.42	0.97
27			0.05	0.12	0.14	0.20	0.16	0.29	0.12	0.16	0.11	0.28
28	C		0.16	0.33	0.42	0.59	0.43	0.75	0.35	0.44	0.29	0.72
29			0.03	0.06	0.05	0.10	0.07	0.13	0.06	0.08	0.05	0.14
30	C		0.05	0.12	0.12	0.18	0.14	0.24	0.12	0.14	0.10	0.25
32	C		0.03	0.06	0.06	0.09	0.07	0.12	0.06	0.07	0.05	0.13
Monounsaturates												
16:1*n*-7	A		0.89	0.76	0.71	1.20	0.78	1.43	0.88	0.71	1.15	0.76
16:1*n*-5	A		0.15	0.15	0.17	0.29	0.19	0.33	0.18	0.17	0.20	0.22
18:1*n*-9	B		0.60	0.49	0.33	0.62	0.36	0.63	0.40	0.33	0.58	0.34
18:1*n*-7	B		0.68	0.52	0.43	0.84	0.55	0.99	0.63	0.46	0.60	0.52
20:1*n*-9	B		0.14	0.13	0.05	0.08	0.04	0.13	0.07	0.04	0.13	0.05
20:1*n*-7	B		0.12	0.04	0.04	0.05	0.04	0.10	0.06	0.03	0.04	0.04
22:1[1]	B		0.12	0.11	0.04	0.05	0.01	0.09	0.03	0.02	0.12	0.02
Polyunsaturates												
18:2			0.21	0.12	0.07	0.14	0.08	0.14	0.12	0.08	0.15	0.08
18:3			0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01
18:4*n*-3	A		0.05	0.05	0.04	0.07	0.04	0.09	0.05	0.04	0.08	0.04
20:2			0.21	0.07	0.05	0.05	0.03	0.05	0.08	0.02	0.06	0.02
20:4*n*-6	A		0.58	0.25	0.17	0.23	0.14	0.29	0.27	0.15	0.28	0.15
20:5*n*-3	A		0.33	0.21	0.15	0.20	0.10	0.39	0.12	0.11	0.27	0.09
22:6*n*-3	A		0.22	0.12	0.09	0.11	0.05	0.29	0.07	0.05	0.13	0.05
Branched												
i-15	B		0.15	0.15	0.15	0.25	0.16	0.25	0.18	0.16	0.19	0.22
ai-15	B		0.18	0.18	0.23	0.34	0.23	0.32	0.22	0.19	0.23	0.28
i-17	B		0.09	0.05	0.04	0.08	0.05	0.10	0.08	0.05	0.08	0.08
ai-17	B		0.07	0.06	0.06	0.09	0.06	0.12	0.08	0.06	0.07	0.07
Total			7.79	7.24	7.44	11.27	7.87	13.95	7.96	7.26	8.47	10.17
Σ assigned to A			2.51	1.82	1.66	2.59	1.64	3.39	1.88	1.55	2.50	1.73
% assigned to A			32	25	22	23	21	24	24	21	29	17
Σ assigned to B			2.23	1.81	1.47	2.57	1.63	2.93	1.88	1.45	2.15	1.77
% assigned to B			29	25	20	23	21	21	24	20	25	17
Σ assigned to C			0.71	1.29	1.57	2.28	1.81	3.06	1.46	1.75	1.22	2.93
% assigned to C			9	18	21	20	23	22	18	24	14	29
16:1/16:0			0.8	0.7	0.6	0.8	0.7	0.8	0.8	0.7	0.9	0.6
18:1/18:0			6.9	5.9	4.3	4.7	3.8	4.1	4.1	4.2	6.2	2.7

[1] 22:1*n*-11+22:1*n*-9

Table 18 Concentrations (µg/g Sed.) of Fatty Acids and Fatty Acid-Ratios in sea-ice sediments.

Fatty Acid	assigned group	Station	57/01-1	62/01-1	62/02-1	62/03-1	62/04-1	62/05-1	62/05-2	62/06-1	62/07-1
n-Saturates											
14	A		11.03	n.d.	4.74	43.58	179.66	52.30	10.10	74.03	14.76
15	B		0.95	n.d.	0.86	3.19	8.41	2.74	0.94	5.77	1.03
16			34.26	n.d.	13.50	111.75	689.48	142.75	30.29	236.89	40.43
17	B		0.36	n.d.	0.42	0.61	1.94	0.61	0.24	1.31	0.20
18			1.73	n.d.	1.81	4.06	18.24	4.17	1.28	14.29	0.94
20			1.52	n.d.	2.03	2.42	7.48	1.65	1.01	3.57	0.90
21			0.51	n.d.	0.47	0.79	1.51	0.38	0.39	1.10	0.38
22			3.08	n.d.	2.87	4.77	11.47	2.36	1.88	7.26	1.45
23			1.44	n.d.	1.03	1.72	3.21	0.80	1.00	2.74	0.55
24	C		7.33	n.d.	4.51	5.51	14.91	3.60	3.89	13.44	2.12
25			1.69	n.d.	1.04	1.52	2.05	0.71	1.08	2.53	0.61
26	C		5.61	n.d.	3.72	3.97	4.99	2.16	2.92	7.72	1.51
27			1.44	n.d.	0.90	1.13	1.08	0.51	0.68	2.13	0.47
28	C		3.84	n.d.	3.09	2.76	2.82	1.52	2.06	6.38	1.13
29			0.62	n.d.	0.46	0.52	0.66	0.30	0.38	1.39	0.24
30	C		1.36	n.d.	1.14	1.33	1.18	1.02	0.62	3.79	0.87
32	C		0.59	n.d.	0.48	0.89	0.55	0.21	0.27	1.88	0.25
Monounsaturates											
16:1*n*-7	A		103.12	n.d.	21.28	149.74	840.33	299.24	103.77	233.01	116.25
16:1*n*-5	A		0.56	n.d.	0.85	4.27	n.d.	5.65	0.57	5.67	1.51
18:1*n*-9	B		7.45	n.d.	2.76	40.81	140.56	26.53	8.32	49.36	6.75
18:1*n*-7	B		2.50	n.d.	0.97	5.22	19.41	4.49	1.78	9.79	0.90
20:1*n*-9	B		0.12	n.d.	0.12	0.63	2.44	0.36	0.04	0.92	0.06
20:1*n*-7	B		0.14	n.d.	0.17	0.34	0.96	0.26	0.23	0.56	0.21
22:1[1]	B		0.49	n.d.	0.38	0.89	6.51	1.38	0.29	1.30	0.31
Polyunsaturates											
18:2			2.28	n.d.	0.90	6.30	6.73	2.15	1.53	5.91	0.93
18:3			0.29	n.d.	0.15	2.64	4.59	0.74	0.91	0.69	1.06
18:4*n*-3	A		0.54	n.d.	0.52	7.88	11.38	3.36	0.90	3.19	1.34
20:2			0.06	n.d.	0.01	1.90	3.84	1.09	0.08	0.93	0.47
20:4*n*-6	A		0.06	n.d.	0.02	0.40	1.75	0.60	0.15	0.31	0.21
20:5*n*-3	A		3.93	n.d.	2.36	19.34	101.22	16.88	9.36	9.68	8.92
22:6*n*-3	A		0.13	n.d.	0.31	4.63	9.24	1.22	0.96	0.64	0.92
Branched											
i-15	B		1.06	n.d.	1.23	1.04	3.85	1.14	1.04	2.85	0.35
ai-15	B		1.19	n.d.	1.20	2.79	8.93	1.26	0.90	3.05	0.42
i-17	B		1.08	n.d.	0.53	2.20	7.81	4.83	0.70	3.58	0.80
ai-17	B		0.42	n.d.	0.44	1.17	3.30	0.40	0.28	0.56	0.14
Total			202.79	n.d.	77.24	442.71	2122.50	589.38	190.85	718.24	209.38
Σ assigned to A			119.37	n.d.	30.07	229.83	1143.59	379.24	125.81	326.53	143.91
% assigned to A			58.87	n.d.	38.93	51.92	53.88	64.35	65.92	45.46	68.73
Σ assigned to B			15.76	n.d.	9.07	58.90	204.12	43.99	14.77	79.07	11.17
% assigned to B			7.77	n.d.	11.75	13.30	9.62	7.46	7.74	11.01	5.33
Σ assigned to C			18.73	n.d.	12.94	14.46	24.45	8.52	9.77	33.21	5.87
% assigned to C			9.24	n.d.	16.75	3.27	1.15	1.45	5.12	4.62	2.80
16:1/16:0			3.0	n.d.	1.6	1.4	1.2	2.1	3.4	1.0	2.9
18:1/18:0			5.8	n.d.	2.1	11.3	8.8	7.4	7.9	4.1	8.1

[1] 22:1*n*-11+22:1*n*-9

Table 18 (continued)

Fatty Acid	assigned group	Station	62/07-2	62/08-1	62/08-2	62/08-3	62/09-1	62/10-1	64/02-1	64/05-1	64/11-1
n-Saturates											
14	A		56.59	0.97	2.07	2.08	15.56	4.79	60.14	4.92	22.14
15	B		4.29	0.15	0.29	0.27	1.17	0.54	4.65	0.46	1.92
16			405.37	4.48	9.14	7.76	49.40	16.23	334.37	13.82	52.68
17	B		0.90	0.14	0.22	0.21	0.32	0.16	1.04	0.15	0.44
18			6.48	0.75	1.19	1.22	1.97	0.74	5.92	0.64	1.84
20			3.55	0.74	0.87	1.49	1.13	0.73	1.88	0.67	1.79
21			1.08	0.22	0.33	0.51	0.50	0.22	0.55	0.29	0.77
22			4.87	1.06	1.42	2.35	2.46	1.01	3.19	1.19	3.06
23			2.45	0.41	0.56	1.10	1.00	0.40	1.08	0.52	1.56
24	C		8.86	1.37	2.00	3.31	3.89	1.79	4.94	1.87	5.14
25			2.21	0.07	0.20	0.39	1.03	0.46	0.98	0.52	1.41
26	C		5.03	0.27	0.49	1.06	3.05	1.59	2.55	1.33	3.55
27			1.33	0.04	0.08	0.17	0.86	0.41	0.61	0.34	1.18
28	C		3.15	0.16	0.26	0.62	2.22	1.28	1.66	0.83	2.69
29			0.57	0.03	0.05	0.09	0.42	0.22	0.35	0.18	0.57
30	C		1.20	0.12	0.15	0.30	0.82	0.69	1.24	0.39	1.21
32	C		0.45	0.07	0.12	0.18	0.25	0.34	0.34	0.11	0.56
Monounsaturates											
16:1*n*-7	A		248.02	2.11	7.34	4.52	174.32	41.59	299.35	23.68	182.09
16:1*n*-5	A		39.60	0.29	0.46	0.70	n.d.	0.35	n.d.	0.80	3.13
18:1*n*-9	B		24.33	8.59	16.93	11.77	34.06	3.46	17.92	3.72	9.40
18:1*n*-7	B		3.33	0.68	1.44	1.70	3.90	0.86	3.57	0.82	2.79
20:1*n*-9	B		0.22	0.15	0.29	0.06	0.22	0.05	0.26	0.06	0.11
20:1*n*-7	B		0.43	0.03	0.04	0.13	0.23	0.12	0.22	0.11	0.22
22:1[1]	B		1.20	0.09	0.14	0.21	0.54	0.15	0.49	0.17	0.92
Polyunsaturates											
18:2			1.66	3.98	8.15	6.99	2.97	0.71	1.50	0.58	3.13
18:3			3.01	0.06	0.17	0.17	1.52	0.35	0.69	0.15	1.79
18:4*n*-3	A		3.83	0.39	0.85	0.62	2.89	0.41	2.36	0.49	2.15
20:2			1.17	0.04	0.08	0.33	0.59	0.03	0.94	0.04	5.15
20:4*n*-6	A		0.49	0.05	0.11	0.09	0.34	0.06	0.13	0.06	0.31
20:5*n*-3	A		22.73	0.82	1.52	1.16	23.50	4.08	15.15	2.40	21.75
22:6*n*-3	A		1.50	0.04	0.06	0.09	0.55	0.58	0.93	0.34	0.50
Branched											
i-15	B		0.90	0.47	0.88	0.95	0.70	0.57	1.08	0.61	1.50
ai-15	B		1.73	0.78	1.29	1.13	1.60	0.56	1.32	0.79	1.91
i-17	B		4.85	0.29	0.48	0.44	0.81	0.33	3.89	0.34	0.74
ai-17	B		0.60	0.45	0.77	0.72	0.93	0.16	0.44	0.13	0.47
Total			867.96	30.34	60.45	54.88	335.69	86.00	775.73	63.50	340.54
Σ assigned to A			372.75	4.67	12.42	9.24	217.16	51.86	378.06	32.68	232.07
% assigned to A			42.95	15.38	20.54	16.84	64.69	60.30	48.74	51.46	68.15
Σ assigned to B			42.77	11.80	22.78	17.60	44.47	6.95	34.87	7.34	20.42
% assigned to B			4.93	38.91	37.69	32.06	13.25	8.08	4.50	11.56	6.00
Σ assigned to C			18.68	1.99	3.02	5.47	10.23	5.68	10.73	4.54	13.13
% assigned to C			2.15	6.56	5.00	9.96	3.05	6.60	1.38	7.14	3.86
16:1/16:0			0.7	0.5	0.9	0.7	3.5	2.6	0.9	1.8	3.5
18:1/18:0			4.3	12.3	15.4	11.1	19.3	5.9	3.6	7.1	6.6

[1] 22:1*n*-11+22:1*n*-9

Table 19 Concentrations (µg/g Sed.) of Sterols in marine sediments.

Sterol	assigned group	Station	2616	2618	2619	2620	2622	2623	2624	2625	2626	2627	2628
		Zone	MIZ	CZ	CZ	CZ	CZ	CZ				MIZ	MIZ
$27^{5,22}$			0.35	0.63	n.d.	0.21	0.36	0.30	n.d.	1.11	n.d.	0.35	0.18
27^{5}			1.04	1.86	n.d.	0.61	1.72	0.77	n.d.	1.63	n.d.	0.61	0.40
$28^{5,22}$	A		0.36	1.09	n.d.	0.36	0.68	0.47	n.d.	0.95	n.d.	0.70	0.40
28^{5}	C		0.13	0.36	n.d.	0.10	0.26	0.22	n.d.	1.40	n.d.	0.18	0.09
$29^{5,22}$	C		0.11	0.37	n.d.	0.10	0.25	0.21	n.d.	0.18	n.d.	0.21	0.09
29^{5}	C		0.80	1.81	n.d.	0.53	1.03	0.78	n.d.	0.70	n.d.	1.05	0.69
Total			2.79	6.11	n.d.	1.90	4.30	2.76	n.d.	5.97	n.d.	3.10	1.85
Σ assigned to A			0.36	1.09	n.d.	0.36	0.68	0.47	n.d.	0.95	n.d.	0.70	0.40
% assigned to A			13	18	n.d.	19	16	17	n.d.	16	n.d.	23	21
Σ assigned to C			1.04	2.53	n.d.	0.73	1.55	1.21	n.d.	2.28	n.d.	1.44	0.88
% assigned to C			37	41	n.d.	38	36	44	n.d.	38	n.d.	46	47

Sterol	assigned group	Station	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2640
		Zone	MIZ	ICZ	CZ	CZ	CZ	CZ			CZ	CZ	CZ
$27^{5,22}$			0.25	0.22	0.32	0.13	0.35	0.38	n.d.	0.50	0.20	0.22	0.36
27^{5}			0.92	0.77	1.11	0.63	0.72	1.35	n.d.	1.34	0.47	0.68	2.39
$28^{5,22}$	A		0.36	0.35	0.42	0.22	0.42	0.43	n.d.	0.81	0.40	0.38	0.68
28^{5}	C		0.09	0.08	0.15	0.05	0.12	0.08	n.d.	0.21	0.10	0.20	0.21
$29^{5,22}$	C		0.11	0.08	0.12	0.05	0.14	0.11	n.d.	0.28	0.09	0.14	0.26
29^{5}	C		0.65	0.41	0.61	0.30	0.68	0.63	n.d.	1.22	0.56	0.73	1.14
Total			2.39	1.90	2.73	1.38	2.42	2.99	n.d.	4.35	1.82	2.36	5.04
Σ assigned to A			0.36	0.35	0.42	0.22	0.42	0.43	n.d.	0.81	0.40	0.38	0.68
% assigned to A			15	18	15	16	18	14	n.d.	19	22	16	14
Σ assigned to C			0.85	0.57	0.89	0.40	0.93	0.82	n.d.	1.70	0.75	1.07	1.60
% assigned to C			36	30	33	29	38	27	n.d.	39	41	45	32

Sterol	assigned group	Station	2641	2642	2643	2644	2645	2646	2647	2648	2651	2654	2656
		Zone		CZ	CZ		SOWS	SOWS	SOWS	CZ	CZ	CZ	SOWS
$27^{5,22}$			0.57	0.12	0.22	0.90	0.55	0.38	0.24	1.60	0.21	0.06	0.22
27^{5}			2.54	0.34	0.62	2.46	1.71	0.94	0.79	5.39	0.37	0.16	0.29
$28^{5,22}$	A		0.62	0.16	0.35	2.62	1.44	0.71	0.50	2.07	0.38	0.12	0.42
28^{5}	C		0.29	0.03	0.08	0.26	0.19	0.11	0.09	0.80	0.08	0.01	0.05
$29^{5,22}$	C		0.16	0.05	0.15	0.37	0.28	0.13	0.10	0.39	0.17	0.04	0.12
29^{5}	C		0.71	0.27	0.68	1.32	1.30	0.81	0.64	1.80	0.61	0.14	0.41
Total			4.88	0.96	2.10	7.92	5.47	3.09	2.35	12.06	1.83	0.53	1.50
Σ assigned to A			0.62	0.16	0.35	2.62	1.44	0.71	0.50	2.07	0.38	0.12	0.42
% assigned to A			13	16	17	33	26	23	21	17	21	22	28
Σ assigned to C			1.16	0.35	0.91	1.95	1.77	1.05	0.83	2.99	0.87	0.19	0.57
% assigned to C			24	36	43	25	32	34	35	25	47	37	38

Sterol	assigned group	Station	57/066	57/067	57/068	57/069	57/070	57/075	57/076	57/077	57/080	57/082	57/083
		Zone	ICZ	ICZ		ICZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
$27^{5,22}$			0.39	0.07	0.10	0.16	0.39	0.25	0.35	0.42	0.20	0.28	0.22
27^{5}			1.41	0.30	0.25	0.38	0.75	0.74	0.60	0.65	0.59	0.83	0.37
$28^{5,22}$	A		0.78	0.12	0.24	0.29	0.72	0.39	0.63	0.63	0.37	0.46	0.41
28^{5}	C		0.19	0.03	0.06	0.06	0.12	0.10	0.14	0.14	0.08	0.11	0.09
$29^{5,22}$	C		0.22	0.04	0.08	0.07	0.23	0.09	0.23	0.26	0.09	0.12	0.10
29^{5}	C		0.79	0.20	0.46	0.42	1.31	0.57	1.20	1.21	0.63	0.81	0.63
Total			3.77	0.76	1.19	1.37	3.52	2.15	3.16	3.31	1.96	2.61	1.80
Σ assigned to A			0.78	0.12	0.24	0.29	0.72	0.39	0.63	0.63	0.37	0.46	0.41
% assigned to A			21	16	20	21	20	18	20	19	19	18	23
Σ assigned to C			1.20	0.27	0.60	0.55	1.66	0.77	1.57	1.62	0.80	1.04	0.81
% assigned to C			32	35	50	40	47	36	50	49	41	40	45

Table 19 (continued)

Sterol	assigned group	Station	57/084	57/085	57/087	57/088	57/090	57/091	57/092	57/093	57/094	57/095	57/097
		Zone	MIZ	MIZ	ICZ	MIZ	MIZ		MIZ	MIZ	MIZ	MIZ	MIZ
$27^{5,22}$			0.30	0.25	0.12	0.29	0.28	n.d.	0.16	0.21	0.44	0.27	0.17
27^{5}			0.59	0.47	0.20	0.52	0.45	n.d.	0.34	0.37	0.83	0.62	0.24
$28^{5,22}$	A		0.62	0.55	0.26	0.57	0.60	n.d.	0.32	0.41	0.85	0.48	0.28
28^{5}	C		0.10	0.09	0.05	0.09	0.14	n.d.	0.07	0.09	0.19	0.11	0.06
$29^{5,22}$	C		0.21	0.16	0.06	0.18	0.13	n.d.	0.08	0.10	0.29	0.10	0.07
29^{5}	C		1.08	0.85	0.36	1.00	0.80	n.d.	0.49	0.61	1.26	0.57	0.42
Total			2.89	2.37	1.06	2.65	2.40	n.d.	1.46	1.79	3.86	2.15	1.24
Σ assigned to A			0.62	0.55	0.26	0.57	0.60	n.d.	0.32	0.41	0.85	0.48	0.28
% assigned to A			21	23	25	21	25	n.d.	22	23	22	22	22
Σ assigned to C			1.39	1.10	0.48	1.27	1.07	n.d.	0.63	0.80	1.74	0.78	0.55
% assigned to C			48	46	45	48	45	n.d.	44	45	45	36	45

Sterol	assigned group	Station	57/098	57/100	57/101	57/102	57/104	57/105	59/064	59/066	59/068	59/070	59/072
		Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
$27^{5,22}$			0.23	0.21	0.29	0.62	0.29	0.50	0.29	0.38	0.16	0.43	0.27
27^{5}			0.39	0.40	0.80	1.03	0.52	1.31	0.63	0.59	0.30	0.71	0.91
$28^{5,22}$	A		0.54	0.51	0.53	1.20	0.58	0.80	0.65	0.60	0.30	0.67	0.35
28^{5}	C		0.08	0.06	0.12	0.30	0.09	0.21	0.09	0.17	0.05	0.16	0.09
$29^{5,22}$	C		0.19	0.15	0.11	0.42	0.20	0.18	0.21	0.13	0.07	0.34	0.07
29^{5}	C		0.89	0.75	0.75	1.64	1.10	1.05	1.09	0.78	0.39	1.35	0.57
Total			2.31	2.08	2.61	5.20	2.77	4.04	2.97	2.64	1.27	3.65	2.25
Σ assigned to A			0.54	0.51	0.53	1.20	0.58	0.80	0.65	0.60	0.30	0.67	0.35
% assigned to A			24	25	20	23	21	20	22	23	24	18	15
Σ assigned to C			1.15	0.96	0.98	2.36	1.38	1.43	1.39	1.07	0.52	1.84	0.73
% assigned to C			50	46	38	45	50	36	47	41	41	50	32

Sterol	assigned group	Station	59/074	59/076	59/077	59/079	59/082	59/084	59/085	59/086	62/002	62/004	62/012
		Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ		MIZ	SOWZ	SOWZ	SOWZ
$27^{5,22}$			0.37	0.44	0.62	0.27	0.24	0.34	n.d.	0.38	0.13	0.15	0.16
27^{5}			0.57	0.77	1.09	0.55	0.57	0.53	n.d.	1.01	1.24	0.52	0.57
$28^{5,22}$	A		0.74	0.80	1.22	0.49	0.42	0.65	n.d.	0.49	0.17	0.26	0.22
28^{5}	C		0.14	0.15	0.25	0.09	0.08	0.12	n.d.	0.13	0.07	0.06	0.06
$29^{5,22}$	C		0.26	0.29	0.44	0.19	0.09	0.26	n.d.	0.10	0.04	0.08	0.07
29^{5}	C		1.21	1.40	2.02	1.05	0.61	1.16	n.d.	0.70	0.31	0.36	0.31
Total			3.28	3.85	5.64	2.63	2.01	3.06	n.d.	2.82	1.96	1.43	1.39
Σ assigned to A			0.74	0.80	1.22	0.49	0.42	0.65	n.d.	0.49	0.17	0.26	0.22
% assigned to A			23	21	22	19	21	21	n.d.	17	9	18	16
Σ assigned to C			1.60	1.84	2.71	1.32	0.78	1.55	n.d.	0.94	0.42	0.50	0.44
% assigned to C			49	48	48	50	39	50	n.d.	33	21	35	31

Sterol	assigned group	Station	62/015	62/017	62/020	62/021	62/026	62/027	62/028	62/029	62/035	62/038	62/041
		Zone	SOWZ	SOWZ	SOWZ	SOWZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
$27^{5,22}$			0.31	0.55	0.20	0.32	0.34	0.24	0.34	0.24	0.27	0.17	0.33
27^{5}			1.19	1.53	0.44	0.94	0.92	0.78	0.79	0.64	0.64	0.43	0.74
$28^{5,22}$	A		0.47	0.74	0.43	0.60	0.59	0.30	0.56	0.34	0.48	0.21	0.38
28^{5}	C		0.19	0.20	0.10	0.13	0.12	0.09	0.09	0.09	0.06	0.05	0.09
$29^{5,22}$	C		0.13	0.14	0.10	0.11	0.20	0.06	0.21	0.06	0.15	0.07	0.08
29^{5}	C		0.69	0.99	0.56	0.75	1.08	0.51	1.07	0.50	0.83	0.41	0.55
Total			2.98	4.15	1.84	2.85	3.25	1.99	3.07	1.88	2.43	1.34	2.16
Σ assigned to A			0.47	0.74	0.43	0.60	0.59	0.30	0.56	0.34	0.48	0.21	0.38
% assigned to A			16	18	23	21	18	15	18	18	20	15	18
Σ assigned to C			1.01	1.33	0.76	0.98	1.40	0.66	1.37	0.66	1.04	0.53	0.71
% assigned to C			34	32	41	35	43	33	45	35	43	40	33

Table 19 (continued)

Sterol	assigned group	Station	62/044	62/046	62/048	62/050	62/054	62/056	62/058	64/487	64/488	64/489	64/490
		Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	CZ	CZ	ICZ	ICZ
$27^{5,22}$			0.36	0.31	0.42	0.20	0.28	0.42	0.30	0.43	0.26	0.22	0.25
27^{5}			0.45	0.88	0.83	0.40	0.59	0.82	0.69	1.08	0.65	0.47	0.64
$28^{5,22}$	A		0.62	0.51	0.77	0.34	0.74	0.60	0.48	0.56	0.42	0.42	0.47
28^{5}	C		0.10	0.12	0.14	0.08	0.11	0.15	0.11	0.25	0.15	0.10	0.14
$29^{5,22}$	C		0.25	0.20	0.27	0.07	0.24	0.12	0.10	0.19	0.16	0.12	0.14
29^{5}	C		1.15	1.12	1.26	0.57	1.25	0.85	0.66	0.84	0.64	0.53	0.55
Total			2.93	3.14	3.68	1.65	3.22	2.96	2.33	3.35	2.27	1.86	2.18
Σ assigned to A			0.62	0.51	0.77	0.34	0.74	0.60	0.48	0.56	0.42	0.42	0.47
% assigned to A			21	16	21	21	23	20	21	17	18	22	21
Σ assigned to C			1.50	1.43	1.66	0.71	1.60	1.12	0.87	1.27	0.95	0.76	0.83
% assigned to C			51	46	45	43	50	38	37	38	42	41	38

Sterol	assigned group	Station	64/504	64/506	64/508	64/511	64/516	64/526	64/528	64/529	64/531	64/573	64/581
		Zone	ICZ	ICZ	ICZ	ICZ	ICZ	MIZ	ICZ	ICZ	ICZ	CZ	ICZ
$27^{5,22}$			0.19	0.14	0.11	0.32	0.36	0.42	0.26	0.26	0.25	0.54	0.27
27^{5}			0.38	0.28	0.21	0.75	1.21	0.65	0.68	0.51	0.40	1.22	0.84
$28^{5,22}$	A		0.39	0.34	0.28	0.65	0.53	0.65	0.51	0.49	0.55	0.78	0.47
28^{5}	C		0.08	0.05	0.07	0.16	0.15	0.16	0.10	0.07	0.09	0.26	0.14
$29^{5,22}$	C		0.10	0.09	0.10	0.15	0.16	0.22	0.14	0.13	0.16	0.28	0.13
29^{5}	C		0.60	0.53	0.50	0.68	0.64	0.80	0.77	0.63	0.79	1.11	0.61
Total			1.74	1.43	1.27	2.73	3.04	2.90	2.46	2.09	2.24	4.19	2.46
Σ assigned to A			0.39	0.34	0.28	0.65	0.53	0.65	0.51	0.49	0.55	0.78	0.47
% assigned to A			23	24	22	24	17	22	21	24	25	19	19
Σ assigned to C			0.78	0.67	0.67	1.00	0.95	1.18	1.01	0.83	1.04	1.65	0.88
% assigned to C			45	47	52	37	31	41	41	40	46	40	36

Sterol	assigned group	Station	64/582	64/583	64/584	64/585	64/586	64/628	64/706	64/707	64/708	64/710
		Zone	ICZ	ICZ		ICZ	ICZ	MIZ	SOWZ	MIZ	MIZ	MIZ
$27^{5,22}$			0.35	0.16	0.09	0.20	0.16	0.49	0.13	0.16	0.15	0.16
27^{5}			0.83	0.52	20.25	0.34	0.30	0.93	0.42	0.51	0.35	0.35
$28^{5,22}$	A		0.63	0.34	3.01	0.43	0.34	0.90	0.25	0.31	0.36	0.35
28^{5}	C		0.16	0.07	0.28	0.09	0.06	0.22	0.06	0.07	0.05	0.05
$29^{5,22}$	C		0.16	0.12	0.15	0.14	0.10	0.29	0.11	0.13	0.13	0.12
29^{5}	C		0.88	0.51	0.85	0.70	0.59	1.08	0.42	0.55	0.60	0.57
Total			3.01	1.72	24.64	1.90	1.55	3.92	1.39	1.73	1.65	1.60
Σ assigned to A			0.63	0.34	3.01	0.43	0.34	0.90	0.25	0.31	0.36	0.35
% assigned to A			21	20	12	23	22	23	18	18	22	22
Σ assigned to C			1.20	0.70	1.27	0.93	0.75	1.59	0.59	0.74	0.79	0.74
% assigned to C			40	41	5	49	49	41	42	43	48	46

Table 20 Concentrations (µg/g TOC) of *n*-alkanes and CPI in marine sediments.

n-Alkane	assigned group	Station	2616	2618	2619	2620	2622	2623	2624	2625	2626	2627	2628
		Zone	MIZ	CZ	CZ	CZ	CZ	CZ				MIZ	MIZ
15	A		5	7	6	4	25	19	11	5	2	8	29
16			5	8	8	7	27	22	13	5	2	8	30
17	A		7	9	9	33	21	18	13	7	1	10	60
18			7	8	8	10	17	14	12	6	2	8	30
19	A		11	12	11	12	17	14	14	17	5	10	29
20			10	7	8	10	13	10	11	7	3	10	22
21			15	8	9	12	14	10	11	8	4	16	26
22			14	7	8	11	13	10	11	7	4	16	23
23			26	10	12	16	17	13	14	11	8	29	36
24			15	7	8	12	12	9	10	7	4	17	20
25			31	11	13	18	20	15	16	12	8	34	41
26			13	6	8	10	12	8	9	7	3	14	17
27	C		41	14	17	18	23	18	19	16	11	45	55
28			10	5	6	8	9	6	7	7	2	10	14
29	C		42	17	19	20	21	18	18	21	15	47	61
30			5	3	5	4	6	4	5	4	2	7	8
31	C		37	15	19	19	20	18	18	18	13	42	58
32			5	3	3	3	4	3	3	3	1	4	7
33	C		12	5	8	8	8	7	7	5	5	14	20
34			1	1	1	2	2	1	1	1	1	1	2
Total			313	161	185	236	302	238	223	177	95	353	590
Σ assigned to A			23	27	25	49	63	51	38	29	9	28	118
% assigned to A			7	17	14	21	21	21	17	17	9	8	20
Σ assigned to C			132	51	63	65	72	62	62	61	43	149	194
% assigned to C			42	32	34	27	24	26	28	35	45	42	33
CPI			4.0	3.1	3.0	2.6	2.5	2.9	2.8	2.9	5.1	4.3	4.2

n-Alkane	assigned group	Station	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2640
		Zone	MIZ	ICZ	CZ	CZ	CZ	CZ			CZ	CZ	CZ
15	A		3	3	1	5	2	4	3	4	7	3	8
16			4	3	3	5	3	4	4	5	8	5	11
17	A		12	5	5	6	3	6	4	5	13	11	11
18			7	5	6	8	3	5	3	5	13	7	11
19	A		10	6	9	14	6	12	5	7	17	9	17
20			8	6	7	10	3	4	3	5	17	7	9
21			12	8	8	13	4	7	4	5	28	8	11
22			11	8	7	11	3	6	4	5	29	8	10
23			20	10	11	16	6	10	6	7	55	10	18
24			12	7	7	9	4	6	4	5	33	7	10
25			24	12	14	22	8	11	7	8	69	11	21
26			11	6	8	10	4	5	3	4	29	7	10
27	C		34	16	20	29	12	15	11	12	97	14	32
28			9	6	7	10	3	4	3	3	24	5	9
29	C		38	18	26	34	18	23	22	22	108	17	53
30			6	4	4	6	2	2	2	2	15	4	8
31	C		38	18	21	21	12	18	18	17	102	16	40
32			5	0	3	3	2	2	2	2	12	3	5
33	C		13	7	8	8	5	7	7	8	37	6	17
34			2	1	1	1	1	0	1	0	3	1	2
Total			279	149	177	241	105	151	116	133	716	158	312
Σ assigned to A			25	14	15	25	11	21	12	16	37	23	37
% assigned to A			9	9	9	10	11	14	10	12	5	15	12
Σ assigned to C			123	58	75	92	47	63	58	59	344	53	141
% assigned to C			44	39	42	38	45	42	50	44	48	34	45
CPI			4.0	3.5	3.5	3.5	4.1	4.7	5.3	4.9	4.3	2.9	4.4

Table 20 (continued)

n-Alkane	assigned group	Station	2641	2642	2643	2644	2645	2646	2647	2648	2651	2654	2656
		Zone		CZ	CZ		SOWS	SOWS	SOWS	CZ	CZ	CZ	SOWS
15	A		4	2	0	8	3	0	3	18	2	3	3
16			5	3	0	8	3	2	4	21	3	3	4
17	A		14	4	32	10	4	3	7	25	3	5	5
18			9	5	29	10	4	4	6	22	3	6	5
19	A		10	13	15	23	7	6	9	25	6	14	7
20			8	8	9	13	5	5	7	25	7	10	4
21			9	10	10	24	8	9	10	21	9	11	15
22			8	9	11	25	8	9	10	21	9	10	5
23			11	14	18	55	16	17	19	25	16	13	7
24			7	8	11	32	10	10	12	18	9	6	5
25			13	13	20	76	20	21	24	23	15	11	9
26			8	6	9	32	9	9	11	16	7	6	4
27	C		17	16	31	115	29	29	33	27	18	14	13
28			7	5	6	34	8	8	9	13	6	5	4
29	C		21	23	28	143	32	33	38	31	21	17	17
30			4	3	4	17	4	4	5	8	4	3	3
31	C		21	19	24	141	32	33	35	25	18	13	20
32			4	2	5	16	4	4	5	8	4	2	3
33	C		8	7	9	52	11	12	12	11	7	4	8
34			1	1	1	5	1	1	1	3	1	1	1
Total			188	172	274	838	219	218	260	388	168	159	143
Σ assigned to A			28	19	47	41	14	10	19	69	11	22	15
% assigned to A			15	11	17	5	6	5	7	18	6	14	11
Σ assigned to C			67	65	92	452	104	107	118	94	65	49	59
% assigned to C			36	38	34	54	48	49	45	24	39	31	41
CPI			3.1	3.8	3.8	4.6	4.4	4.3	4.0	2.1	3.1	3.1	3.9

n-Alkane	assigned group	Station	57/066	57/067	57/068	57/069	57/070	57/075	57/076	57/077	57/080	57/082	57/083
		Zone	ICZ	ICZ		ICZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
15	A		2	3	1	4	12	4	7	7	3	4	6
16			3	4	3	6	16	4	9	7	3	4	6
17	A		5	6	5	10	16	7	10	8	5	7	10
18			5	6	6	10	14	7	9	7	6	7	9
19	A		6	8	9	13	17	10	14	11	9	10	11
20			6	8	9	13	14	10	13	11	10	10	12
21			9	12	14	19	19	17	22	18	16	17	18
22			9	12	14	19	18	17	22	17	16	17	18
23			14	22	25	32	31	31	39	32	29	32	32
24			9	14	15	18	17	18	23	18	17	18	18
25			17	26	31	36	35	37	46	37	35	38	37
26			7	11	13	16	15	15	19	16	15	15	16
27	C		22	34	42	47	47	49	62	51	48	52	49
28			6	8	10	11	11	12	13	12	12	12	12
29	C		22	37	45	49	51	52	66	53	52	56	51
30			3	5	6	7	7	6	8	7	7	7	7
31	C		19	34	44	43	48	49	64	49	49	53	47
32			3	4	6	6	5	6	6	4	7	6	6
33	C		6	12	15	14	17	17	23	17	17	17	16
34			1	1	2	2	2	2	2	2	2	2	2
Total			174	268	315	375	412	370	477	385	356	384	384
Σ assigned to A			14	16	15	28	45	21	30	26	17	21	28
% assigned to A			8	6	5	7	11	6	6	7	5	6	7
Σ assigned to C			69	117	146	152	164	166	215	170	166	177	164
% assigned to C			39	44	46	41	40	45	45	44	47	46	43
CPI			3.7	4.0	4.1	3.8	4.3	4.3	4.6	4.3	4.2	4.4	4.0

Table 20 (continued)

n-Alkane	assigned group	Station	57/084	57/085	57/087	57/088	57/090	57/091	57/092	57/093	57/094	57/095	57/097
		Zone	MIZ	MIZ	ICZ	MIZ	MIZ		MIZ	MIZ	MIZ	MIZ	MIZ
15	A		5	17	5	9	3	28	7	5	11	6	8
16			5	15	6	10	5	24	8	6	10	7	9
17	A		6	13	8	13	9	22	12	17	12	11	10
18			6	11	8	12	9	19	11	10	10	9	10
19	A		9	14	12	15	13	22	14	14	13	14	13
20			9	12	12	14	13	16	13	13	12	13	12
21			16	18	19	21	21	24	20	20	19	21	20
22			16	17	19	20	20	20	19	20	18	21	19
23			29	31	35	37	38	34	35	35	35	38	37
24			17	18	19	21	21	18	20	20	20	22	21
25			34	36	40	43	42	36	39	41	39	44	43
26			15	15	17	19	18	14	16	18	17	19	18
27	C		46	49	55	58	55	45	50	56	52	60	60
28			11	11	13	14	14	10	11	14	12	15	14
29	C		49	53	58	62	57	45	49	61	53	63	65
30			7	7	8	9	9	5	1	8	7	8	10
31	C		47	51	55	58	53	40	45	58	48	60	62
32			4	4	8	5	8	4	6	7	4	8	9
33	C		16	18	18	20	18	14	15	20	16	21	21
34			1	2	4	2	2	1	2	2	1	2	2
Total			348	413	421	464	427	442	391	444	411	459	462
Σ assigned to A			19	44	25	37	25	73	33	35	36	31	31
% assigned to A			5	11	6	8	6	16	8	8	9	7	7
Σ assigned to C			159	171	186	199	184	144	159	194	169	203	208
% assigned to C			46	42	44	43	43	33	41	44	41	44	45
CPI			4.3	4.5	4.0	4.2	3.9	4.5	4.7	4.1	4.2	4.1	4.1

n-Alkane	assigned group	Station	57/098	57/100	57/101	57/102	57/104	57/105	59/064	59/066	59/068	59/070	59/072
		Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
15	A		8	8	5	18	11	5	7	6	6	8	16
16			9	8	5	23	10	6	8	8	7	8	19
17	A		9	9	8	24	10	9	9	9	9	10	21
18			8	8	8	22	9	9	8	9	9	8	17
19	A		13	11	11	24	12	12	11	13	13	12	21
20			12	11	11	19	12	11	11	12	12	11	16
21			19	17	18	25	19	18	17	18	19	18	22
22			19	17	18	22	19	18	18	18	19	18	20
23			34	30	32	37	34	32	33	32	34	32	35
24			19	17	18	20	20	18	18	18	19	18	19
25			38	35	35	40	40	38	35	33	38	37	37
26			16	15	14	16	17	16	15	13	16	16	15
27	C		50	48	44	52	53	50	47	41	50	50	48
28			11	11	11	12	12	120	11	9	11	11	11
29	C		53	50	45	54	58	52	48	42	53	51	51
30			7	7	6	7	7	7	6	6	7	7	6
31	C		48	47	42	49	53	47	43	38	49	47	47
32			5	4	6	4	7	6	4	4	6	6	5
33	C		17	16	14	17	18	15	15	13	17	15	16
34			1	1	1	1	1	2	1	1	2	1	1
Total			393	368	352	485	423	491	367	344	393	384	445
Σ assigned to A			29	27	24	67	34	26	27	28	27	30	58
% assigned to A			7	7	7	14	8	5	7	8	7	8	13
Σ assigned to C			167	160	145	171	182	165	154	134	169	163	162
% assigned to C			43	44	41	35	43	34	42	39	43	42	36
CPI			4.3	4.4	4.0	4.5	4.2	1.3	4.3	4.2	4.3	4.2	4.4

Table 20 (continued)

n-Alkane	assigned group	Station	59/074	59/076	59/077	59/079	59/082	59/084	59/085	59/086	62/002	62/004	62/012
		Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ		MIZ	SOWZ	SOWZ	SOWZ
15	A		6	9	9	6	4	5	7	5	5	11	3
16			8	10	8	7	6	6	7	6	3	2	3
17	A		9	13	10	9	9	7	8	9	4	2	3
18			8	10	8	8	9	7	8	8	4	3	4
19	A		12	14	11	11	13	10	12	11	6	4	7
20			11	12	11	11	12	9	11	11	7	3	4
21			17	18	17	18	20	15	18	18	7	5	5
22			17	17	17	17	20	15	18	17	8	5	4
23			32	31	31	30	37	27	31	32	11	9	7
24			17	18	18	17	22	16	18	18	9	6	5
25			33	36	35	33	45	31	35	36	14	12	8
26			14	16	15	14	19	13	14	15	8	5	5
27	C		45	50	46	43	61	41	45	48	17	16	9
28			10	13	11	10	15	10	10	11	6	4	4
29	C		47	56	46	47	65	44	44	50	20	19	10
30			6	11	6	6	8	6	6	6	4	3	2
31	C		42	56	41	44	63	41	41	48	20	20	10
32			5	11	4	5	8	4	4	6	4	3	2
33	C		17	22	14	15	22	14	14	16	8	8	3
34			1	5	1	1	2	1	1	2	1	1	1
Total			357	428	358	351	460	320	353	370	166	143	99
Σ assigned to A			27	35	30	26	26	21	27	25	15	18	13
% assigned to A			8	8	8	7	6	7	8	7	9	13	14
Σ assigned to C			151	184	146	148	210	140	144	162	65	63	32
% assigned to C			42	43	41	42	46	44	41	44	39	44	33
CPI			4.3	3.6	4.2	4.2	4.2	4.4	4.2	4.3	3.1	3.9	2.7

n-Alkane	assigned group	Station	62/015	62/017	62/020	62/021	62/026	62/027	62/028	62/029	62/035	62/038	62/041
		Zone	SOWZ	SOWZ	SOWZ	SOWZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
15	A		5	14	13	12	6	12	8	3	6	4	12
16			4	11	12	8	5	10	6	3	7	4	9
17	A		5	11	13	9	6	11	7	4	8	6	9
18			5	9	10	8	6	9	6	4	7	6	8
19	A		8	13	12	10	8	13	8	7	10	10	10
20			6	8	10	9	8	10	8	7	9	9	9
21			8	10	14	13	13	15	13	12	12	13	13
22			7	9	13	13	13	14	13	13	12	12	12
23			13	15	23	24	24	24	23	23	19	21	20
24			8	9	14	14	14	14	14	14	12	13	12
25			16	18	27	28	27	26	28	28	23	25	24
26			7	9	12	12	11	10	12	12	11	12	11
27	C		21	23	36	38	35	31	38	36	30	33	31
28			6	7	9	8	8	7	9	8	8	10	8
29	C		24	25	40	40	38	30	41	37	33	34	33
30			4	4	6	5	5	4	5	4	5	7	5
31	C		24	23	38	36	37	27	39	35	32	32	31
32			3	4	5	4	3	3	5	3	4	4	3
33	C		9	8	14	12	13	9	13	11	12	12	11
34			1	1	1	1	1	1	1	1	1	2	1
Total			183	231	319	302	282	279	297	265	260	269	270
Σ assigned to A			17	37	37	30	20	36	23	14	24	20	30
% assigned to A			10	16	12	10	7	13	8	5	9	7	11
Σ assigned to C			78	80	128	125	124	97	131	119	107	110	106
% assigned to C			43	35	40	42	44	35	44	45	41	41	39
CPI			3.9	3.6	4.1	4.3	4.5	4.2	4.3	4.4	3.9	3.3	4.1

Table 20 (continued)

n-Alkane	assigned group	Station	62/044	62/046	62/048	62/050	62/054	62/056	62/058	64/487	64/488	64/489	64/490
		Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	CZ	CZ	ICZ	ICZ
15	A		5	7	11	8	8	7	8	1	7	4	8
16			3	5	9	5	7	8	5	1	6	6	6
17	A		4	7	10	5	8	11	7	2	5	9	6
18			5	7	8	5	8	9	6	2	4	7	5
19	A		7	9	11	8	11	13	8	4	5	9	6
20			7	9	10	8	11	12	9	3	3	6	5
21			11	15	15	14	16	18	15	4	4	7	6
22			12	14	15	14	16	17	15	3	4	6	6
23			20	26	25	25	29	32	28	6	7	11	9
24			12	15	15	15	16	17	16	4	4	6	5
25			25	31	29	29	31	34	32	11	8	12	11
26			11	13	12	12	13	14	13	5	4	5	5
27	C		32	42	37	38	39	41	43	15	12	18	16
28			8	9	8	8	8	9	10	4	3	4	4
29	C		35	45	38	40	40	40	47	15	12	21	18
30			5	6	5	5	5	4	6	3	2	3	3
31	C		32	42	36	38	36	34	45	11	12	20	18
32			3	6	3	3	3	5	4	1	1	1	1
33	C		11	14	13	13	12	11	15	5	5	7	6
34			1	1	1	1	1	0	1	1	1	1	0
Total			250	324	312	294	319	336	336	101	109	163	144
Σ assigned to A			16	23	32	21	27	30	24	7	17	21	20
% assigned to A			6	7	10	7	9	9	7	7	16	13	14
Σ assigned to C			110	143	124	130	127	126	151	47	40	65	59
% assigned to C			44	44	40	44	40	37	45	46	37	40	41
CPI			4.1	4.2	4.3	4.6	4.4	4.1	4.4	3.6	3.9	4.6	4.5

n-Alkane	assigned group	Station	64/504	64/506	64/508	64/511	64/516	64/526	64/528	64/529	64/531	64/573	64/581
		Zone	ICZ	ICZ	ICZ	ICZ	ICZ	MIZ	ICZ	ICZ	ICZ	CZ	ICZ
15	A		11	8	8	4	2	6	12	7	11	6	3
16			11	8	8	3	2	6	8	12	9	5	3
17	A		14	10	9	4	3	8	9	17	11	5	4
18			12	8	8	3	3	7	8	13	10	4	4
19	A		14	10	9	4	5	9	10	15	13	5	5
20			13	10	9	3	4	9	10	13	12	4	4
21			18	14	12	5	5	14	15	18	18	6	6
22			17	14	12	4	4	14	15	17	17	5	6
23			27	25	21	8	8	24	26	29	29	8	11
24			16	15	12	5	5	13	15	15	17	6	7
25			29	29	24	10	10	25	28	31	33	11	14
26			13	12	10	4	5	11	12	14	14	5	6
27	C		37	38	33	16	14	32	36	39	42	14	19
28			9	9	8	3	4	7	8	9	10	4	5
29	C		36	38	38	17	17	31	36	39	43	15	21
30			6	5	5	2	3	4	5	6	6	4	4
31	C		34	36	36	18	17	28	34	37	40	15	23
32			3	3	3	1	1	2	3	3	3	1	2
33	C		11	12	12	6	6	9	12	13	13	6	8
34			1	1	1	0	0	1	1	1	1	1	1
Total			332	305	278	122	118	260	304	346	355	130	154
Σ assigned to A			39	28	27	12	11	23	32	38	35	16	12
% assigned to A			12	9	10	10	9	9	10	11	10	12	8
Σ assigned to C			118	124	119	57	54	100	118	128	139	50	70
% assigned to C			36	41	43	47	45	38	39	37	39	38	45
CPI			3.9	4.4	4.5	5.0	4.4	4.2	4.1	4.2	4.1	3.4	4.4

Table 20 (continued)

n-Alkane	assigned	Station	64/582	64/583	64/584	64/585	64/586	64/628	64/706	64/707	64/708	64/710
	group	Zone	ICZ	ICZ		ICZ	ICZ	MIZ	SOWZ	MIZ	MIZ	MIZ
15	A		4	7	8	20	2	7	23	4	4	6
16			4	6	8	15	3	7	9	5	6	6
17	A		5	8	10	16	5	11	11	7	8	8
18			4	7	8	11	5	9	8	6	7	7
19	A		5	7	11	13	8	12	10	7	9	9
20			5	7	10	12	9	12	9	7	9	9
21			7	11	14	18	15	18	13	11	14	15
22			7	11	14	16	15	17	12	10	14	15
23			11	19	25	29	27	31	21	18	25	27
24			7	11	14	16	15	17	12	11	14	15
25			13	22	29	31	29	34	24	22	27	31
26			6	9	12	13	12	14	10	9	11	13
27	C		16	29	39	41	37	44	30	29	36	40
28			4	6	9	10	8	9	7	7	8	10
29	C		18	31	45	43	37	46	34	31	38	42
30			3	4	6	5	5	6	4	4	5	6
31	C		17	29	42	40	34	41	33	29	34	38
32			1	2	3	2	2	3	3	2	3	3
33	C		6	9	14	14	11	14	11	9	11	13
34			1	1	1	1	1	1	1	1	1	1
Total			142	236	321	366	281	354	284	229	285	312
Σ assigned to A			13	22	28	49	15	29	44	18	21	23
% assigned to A			9	9	9	13	5	8	15	8	7	7
Σ assigned to C			57	98	140	138	120	145	107	98	119	133
% assigned to C			40	41	44	38	43	41	38	43	42	43
CPI			4.2	4.6	4.5	4.6	4.4	4.5	4.5	4.6	4.3	4.3

Table 21 Concentrations (µg/g TOC) of *n*-alkanes and CPI in sea-ice sediments.

n-Alkane	assigned group	Station	57/01-1	62/01-1	62/02-1	62/03-1	62/04-1	62/05-1	62/05-2	62/06-1	62/07-1
15	A		15	11	7	1	1	20	1	12	16
16			2	21	1	25	37	10	2	6	3
17	A		8	20	4	68	177	16	6	58	9
18			7	18	4	38	46	8	5	6	9
19	A		20	21	15	75	118	20	15	22	26
20			16	18	17	82	89	20	15	18	33
21			36	24	56	150	178	50	41	52	85
22			34	21	54	144	130	43	42	41	77
23			86	31	143	245	279	105	104	104	170
24			35	19	56	116	90	44	43	36	71
25			81	32	154	220	156	102	113	89	168
26			29	16	50	82	61	40	36	29	51
27	C		97	34	183	213	140	136	141	119	180
28			18	9	29	45	31	30	20	23	34
29	C		61	22	113	151	84	122	86	105	132
30			6	6	15	24	18	19	11	12	19
31	C		45	11	95	122	61	95	70	76	107
32			4	2	7	11	7	9	5	6	8
33	C		14	7	27	42	17	31	23	25	35
34			1	1	2	4	2	4	2	2	3
Total			614	345	1033	1857	1723	923	780	841	1236
Σ assigned to A			43	51	27	145	295	56	21	92	51
% assigned to A			7	15	3	8	17	6	3	11	4
Σ assigned to C			217	74	419	528	303	383	320	325	454
% assigned to C			35	21	41	28	18	42	41	39	37
CPI			4.2	2.5	4.7	3.6	3.0	4.1	4.8	4.8	4.4

n-Alkane	assigned group	Station	62/07-2	62/08-1	62/08-2	62/08-3	62/09-1	62/10-1	64/02-1	64/05-1	64/11-1
15	A		15	16	12	12	63	9	45	9	16
16			21	3	3	3	7	2	17	4	5
17	A		93	25	29	30	23	7	60	13	25
18			34	14	15	19	14	8	12	10	30
19	A		78	35	41	50	30	21	29	27	64
20			77	43	51	62	26	25	26	30	71
21			149	74	90	106	52	57	59	73	137
22			126	60	74	84	50	51	49	69	138
23			230	87	111	119	113	112	116	142	273
24			94	29	39	39	48	48	43	62	128
25			174	51	70	66	109	113	97	142	258
26			64	17	30	20	39	38	36	47	99
27	C		191	45	73	57	117	135	101	155	270
28			38	9	23	11	22	28	22	30	50
29	C		145	27	59	39	74	120	81	124	151
30			17	3	15	6	13	15	12	18	27
31	C		96	23	64	43	60	120	63	103	116
32			6	1	8	1	5	2	5	7	10
33	C		27	5	20	12	20	43	19	34	38
34			2	0	3	0	2	2	2	2	4
Total			1675	565	828	779	887	958	892	1103	1910
Σ assigned to A			186	75	82	93	115	37	134	49	105
% assigned to A			11	13	10	12	13	4	15	4	6
Σ assigned to C			459	100	216	151	271	417	264	416	575
% assigned to C			27	18	26	19	31	44	30	38	30
CPI			3.9	3.8	3.1	4.3	3.8	5.1	3.9	4.4	3.5

Table 22 Concentrations (µg/g TOC) of Fatty Acids and Fatty Acid-Ratios in marine sediments.

Fatty Acid	assigned group	Station	2616	2618	2619	2620	2622	2623	2624	2625	2626	2627	2628
		Zone	MIZ	CZ	CZ	CZ	CZ	CZ				MIZ	MIZ
n-Saturates													
14	A		89	207	506	221	114	72	103	5218	249	88	96
15	B		20	25	37	18	16	11	14	342	37	17	23
16			288	746	1553	610	421	283	365	10480	968	339	380
17	B		10	11	16	8	11	6	8	29	27	10	13
18			65	70	116	49	91	37	24	293	137	52	70
20			31	19	34	11	17	18	14	41	34	36	38
21			9	6	6	3	4	4	5	60	7	10	10
22			49	27	39	15	19	28	20	52	48	53	60
23			24	9	9	4	6	9	8	50	14	27	30
24	C		105	56	61	33	32	50	41	111	80	108	122
25			35	18	13	15	7	12	10	17	16	36	41
26	C		121	58	62	33	28	53	44	97	69	121	138
27			35	14	11	10	6	11	10	8	10	33	39
28	C		87	43	42	19	21	41	32	49	43	98	100
29			18	8	6	5	0	6	6	6	8	17	21
30	C		30	13	15	7	0	21	12	18	15	29	35
32	C		14	4	6	0	5	7	7	0	4	14	20
Monounsaturates													
16:1*n*-7	A		259	1000	3069	1341	526	290	489	0	511	221	255
16:1*n*-5	A		47	71	77	41	27	32	38	29606	60	39	47
18:1*n*-9	B		108	462	496	173	122	78	93	1444	729	114	132
18:1*n*-7	B		163	273	463	134	108	93	112	967	203	156	143
20:1*n*-9	B		23	65	59	11	11	16	13	61	51	18	40
20:1*n*-7	B		10	21	43	7	11	7	8	121	31	30	17
22:1[1]	B		18	39	69	20	15	19	16	275	31	27	49
Polyunsaturates													
18:2			21	105	168	50	28	21	26	622	202	35	41
18:3			1	11	38	13	10	3	4	430	13	2	1
18:4*n*-3	A		13	31	62	29	19	10	12	1093	48	14	12
20:2			7	61	33	7	21	5	5	82	34	23	13
20:4*n*-6	A		25	149	159	36	49	18	16	0	42	45	44
20:5*n*-3	A		37	114	488	165	107	44	54	10615	188	31	39
22:6*n*-3	A		23	44	126	26	28	13	14	684	139	22	24
Branched													
i-15	B		46	70	74	41	30	35	39	83	69	38	46
ai-15	B		56	78	72	38	33	38	41	109	77	43	57
i-17	B		21	24	27	11	10	9	11	37	22	18	17
ai-17	B		20	20	20	10	9	8	10	40	26	17	19
Total			1927	3973	8073	3215	1964	1408	1724	63142	4242	1977	2234
Σ assigned to A			492	1616	4487	1860	869	479	726	47215	1237	459	517
% assigned to A			26	41	56	58	44	34	42	75	29	23	23
Σ assigned to B			494	1090	1374	471	377	321	366	3508	1304	485	556
% assigned to B			26	27	17	15	19	23	21	6	31	25	25
Σ assigned to C			357	174	185	92	87	171	137	275	211	370	415
% assigned to C			19	4	2	3	4	12	8	0	5	19	19
16:1/16:0			1.1	1.4	2.0	2.3	1.3	1.1	1.4	2.8	0.6	0.8	0.8
18:1/18:0			4.2	10.5	8.3	6.2	2.5	4.7	8.5	8.2	6.8	5.1	3.9

[1] 22:1*n*-11+22:1*n*-9

Table 22 (continued)

Fatty Acid	assigned group	Station	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2640
		Zone	MIZ	ICZ	CZ	CZ	CZ	CZ			CZ	CZ	CZ
n-Saturates													
14	A		87	143	234	531	467	538	701	6851	168	201	858
15	B		18	25	23	41	45	44	38	580	37	20	54
16			349	608	702	1340	1563	1925	2050	21243	616	588	2157
17	B		11	14	14	14	22	16	18	279	21	9	22
18			54	91	61	105	153	155	143	1668	111	49	137
20			28	22	20	22	28	35	34	355	50	14	56
21			7	6	5	4	7	5	6	61	18	3	12
22			41	35	28	27	43	44	44	478	84	22	82
23			18	12	9	22	8	11	10	91	45	7	29
24	C		86	72	59	71	59	79	69	736	198	48	119
25			28	15	13	15	13	15	14	162	71	10	29
26	C		99	76	65	93	64	72	61	714	230	56	84
27			24	15	13	17	10	12	10	123	67	10	19
28	C		70	53	49	84	47	47	42	440	169	38	64
29			13	9	8	17	10	6	6	80	35	6	10
30	C		24	16	21	54	26	22	12	151	62	10	27
32	C		12	7	6	19	12	6	4	51	32	5	8
Monounsaturates													
16:1*n*-7	A		261	661	1173	2095	2380	3591	5199	54905	425	908	4584
16:1*n*-5	A		43	76	54	41	94	113	89	1438	79	52	88
18:1*n*-9	B		104	258	212	437	935	1230	769	8976	170	198	927
18:1*n*-7	B		133	293	189	162	575	487	513	8364	234	184	331
20:1*n*-9	B		31	53	20	44	74	75	49	684	30	16	58
20:1*n*-7	B		15	20	15	26	32	50	115	711	26	11	44
22:1[1]	B		29	77	22	83	73	61	50	576	33	24	66
Polyunsaturates													
18:2			28	67	63	98	290	267	168	2827	52	64	275
18:3			2	8	9	11	28	0	28	444	2	10	3
18:4*n*-3	A		11	31	31	23	78	64	132	1246	23	27	44
20:2			13	26	12	13	85	54	37	613	15	8	31
20:4*n*-6	A		38	74	35	16	261	191	56	2728	50	40	88
20:5*n*-3	A		39	169	161	120	328	492	772	7314	59	132	428
22:6*n*-3	A		20	76	53	47	132	204	134	2286	27	30	154
Branched													
i-15	B		47	62	53	57	96	99	72	1173	82	53	79
ai-15	B		50	63	57	57	100	109	83	1217	89	52	77
i-17	B		15	32	17	18	44	42	23	365	26	16	34
ai-17	B		14	21	14	16	27	25	23	363	28	14	28
Total			1866	3285	3522	5841	8209	10183	11572	130291	3464	2932	11107
Σ assigned to A			500	1231	1742	2875	3740	5192	7083	76769	830	1389	6244
% assigned to A			27	37	49	49	46	51	61	59	24	47	56
Σ assigned to B			469	917	638	955	2024	2236	1753	23286	776	596	1720
% assigned to B			25	28	18	16	25	22	15	18	22	20	15
Σ assigned to C			290	224	201	320	207	225	188	2092	692	157	302
% assigned to C			16	7	6	5	3	2	2	2	20	5	3
16:1/16:0			0.9	1.2	1.7	1.6	1.6	1.9	2.6	2.7	0.8	1.6	2.2
18:1/18:0			4.4	6.1	6.6	5.7	9.9	11.1	9.0	10.4	3.6	7.8	9.2

[1] 22:1*n*-11+22:1*n*-9

Table 22 (continued)

Fatty Acid	assigned group	Station	2641	2642	2643	2644	2645	2646	2647	2648	2651	2654	2656
		Zone		CZ	CZ		SOWS	SOWS	SOWS	CZ	CZ	CZ	SOWS
n-Saturates													
14	A		n.d.	734	588	797	131	86	101	288	283	179	66
15	B		n.d.	68	60	122	25	17	20	15	29	29	18
16			n.d.	2189	1995	2428	470	335	384	438	1093	559	230
17	B		n.d.	22	38	63	13	8	11	3	21	13	8
18			n.d.	233	244	362	78	52	54	28	361	94	53
20			n.d.	40	74	107	21	15	22	5	52	29	20
21			n.d.	10	14	29	7	5	8	6	11	7	8
22			n.d.	47	95	204	38	28	37	4	65	40	41
23			n.d.	15	36	214	21	16	18	66	21	13	15
24	C		n.d.	103	155	493	93	74	88	7	104	79	102
25			n.d.	22	41	130	31	23	27	2	24	12	19
26	C		n.d.	75	136	534	112	91	117	6	76	51	112
27			n.d.	16	23	108	28	23	27	2	14	9	23
28	C		n.d.	50	88	337	76	64	72	0	53	30	70
29			n.d.	7	9	55	15	12	15	0	8	5	12
30	C		n.d.	17	25	111	24	23	25	0	15	10	20
32	C		n.d.	0	7	51	13	12	13	0	6	5	0
Monounsaturates													
16:1*n*-7	A		n.d.	2837	218	2663	412	290	362	1151	670	317	224
16:1*n*-5	A		n.d.	65	140	498	78	61	66	17	46	30	63
18:1*n*-9	B		n.d.	1007	1011	972	154	140	161	149	573	201	95
18:1*n*-7	B		n.d.	446	590	1667	272	249	220	139	131	75	190
20:1*n*-9	B		n.d.	63	109	81	31	35	47	95	32	16	16
20:1*n*-7	B		n.d.	41	62	19	14	17	17	13	13	8	6
22:1[1]	B		n.d.	66	105	193	26	28	50	143	62	23	26
Polyunsaturates													
18:2			n.d.	303	250	174	43	38	41	32	139	61	8
18:3			n.d.	20	27	42	4	2	3	7	13	8	0
18:4*n*-3	A		n.d.	64	96	174	25	20	17	44	34	22	15
20:2			n.d.	30	27	241	35	60	25	0	15	6	8
20:4*n*-6	A		n.d.	134	137	531	99	125	72	61	36	9	12
20:5*n*-3	A		n.d.	313	354	1264	119	119	76	16	59	46	11
22:6*n*-3	A		n.d.	112	151	653	63	78	39	71	46	28	9
Branched													
i-15	B		n.d.	94	146	363	65	53	58	17	77	56	43
ai-15	B		n.d.	96	134	439	81	63	65	8	72	61	73
i-17	B		n.d.	38	76	165	34	30	26	6	23	20	16
ai-17	B		n.d.	34	55	117	28	24	21	5	25	17	18
Total			n.d.	9411	7316	16400	2780	2317	2406	2845	4300	2164	1649
Σ assigned to A			n.d.	4259	1683	6579	927	779	733	1647	1173	631	399
% assigned to A			n.d.	45	23	40	33	34	30	58	27	29	24
Σ assigned to B			n.d.	1975	2386	4202	743	663	698	593	1057	518	509
% assigned to B			n.d.	21	33	26	27	29	29	21	25	24	31
Σ assigned to C			n.d.	246	412	1526	318	264	315	13	253	174	303
% assigned to C			n.d.	3	6	9	11	11	13	0	6	8	18
16:1/16:0			n.d.	1.3	0.2	1.3	1.0	1.0	1.1	2.7	0.7	0.6	1.2
18:1/18:0			n.d.	6.2	6.6	7.3	5.5	7.5	7.1	10.1	1.9	2.9	5.3

[1] 22:1*n*-11+22:1*n*-9

Table 22 (continued)

Fatty Acid	assigned group	Station	57/066	57/067	57/068	57/069	57/070	57/075	57/076	57/077	57/080	57/082	57/083
		Zone	ICZ	ICZ		ICZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
n-Saturates													
14	A		122	53	n.d.	105	88	96	105	91	77	90	80
15	B		25	13	n.d.	23	21	18	23	20	17	20	17
16			560	213	n.d.	365	320	307	399	360	268	331	279
17	B		13	10	n.d.	15	11	11	14	11	10	12	10
18			75	53	n.d.	64	61	69	127	111	52	66	51
20			23	23	n.d.	28	38	34	59	56	28	43	27
21			5	9	n.d.	10	13	10	16	15	10	14	11
22			30	33	n.d.	49	65	53	92	97	48	67	49
23			9	19	n.d.	27	36	28	42	44	25	33	32
24	C		52	71	n.d.	111	143	122	178	189	108	132	123
25			14	24	n.d.	37	48	40	61	61	37	4	43
26	C		61	80	n.d.	119	154	130	183	190	120	135	130
27			11	23	n.d.	32	45	36	53	53	34	39	38
28	C		43	56	n.d.	87	136	91	160	173	87	100	93
29			7	12	n.d.	17	23	18	27	26	18	20	18
30	C		13	17	n.d.	30	40	31	49	50	31	36	32
32	C		1	9	n.d.	13	20	15	26	25	15	19	16
Monounsaturates													
16:1*n*-7	A		618	136	n.d.	338	239	214	293	261	193	252	229
16:1*n*-5	A		82	23	n.d.	48	51	40	56	47	36	42	38
18:1*n*-9	B		325	60	n.d.	127	95	97	115	98	76	95	83
18:1*n*-7	B		304	79	n.d.	185	170	142	185	160	122	157	130
20:1*n*-9	B		32	17	n.d.	18	15	23	18	19	11	17	12
20:1*n*-7	B		25	8	n.d.	29	15	15	13	14	11	12	10
22:1[1]	B		30	27	n.d.	19	14	24	20	21	12	17	15
Polyunsaturates													
18:2			102	15	n.d.	29	18	17	19	14	16	19	16
18:3			13	1	n.d.	2	1	0	2	1	0	1	1
18:4*n*-3	A		20	8	n.d.	19	15	13	16	14	11	14	13
20:2			28	9	n.d.	15	8	8	12	10	9	14	7
20:4*n*-6	A		116	34	n.d.	61	41	29	32	32	25	35	30
20:5*n*-3	A		220	31	n.d.	73	45	65	44	43	35	48	45
22:6*n*-3	A		115	18	n.d.	29	22	35	21	20	17	22	17
Branched													
i-15	B		42	31	n.d.	46	43	36	45	38	31	37	33
ai-15	B		51	31	n.d.	55	60	46	66	54	41	47	44
i-17	B		18	12	n.d.	21	14	12	14	13	12	16	10
ai-17	B		16	12	n.d.	20	16	16	18	16	13	16	15
Total			3221	1270	n.d.	2266	2146	1941	2602	2447	1655	2025	1798
Σ assigned to A			1293	303	n.d.	673	501	492	566	507	393	504	453
% assigned to A			40	24	n.d.	30	23	25	22	21	24	25	25
Σ assigned to B			881	300	n.d.	557	475	440	532	465	356	446	380
% assigned to B			27	24	n.d.	25	22	23	20	19	22	22	21
Σ assigned to C			170	232	n.d.	361	493	389	596	627	361	422	393
% assigned to C			5	18	n.d.	16	23	20	23	26	22	21	22
16:1/16:0			1.3	0.7	n.d.	1.1	0.9	0.8	0.9	0.9	0.9	0.9	1.0
18:1/18:0			8.4	2.6	n.d.	4.9	4.4	3.5	2.4	2.3	3.8	3.8	4.2

[1] 22:1*n*-11+22:1*n*-9

Table 22 (continued)

Fatty Acid	assigned group	Station	57/084	57/085	57/087	57/088	57/090	57/091	57/092	57/093	57/094	57/095	57/097
		Zone	MIZ	MIZ	ICZ	MIZ	MIZ		MIZ	MIZ	MIZ	MIZ	MIZ
n-Saturates													
14	A		89	73	98	101	125	106	81	97	99	103	76
15	B		20	16	21	22	27	22	17	20	19	21	16
16			343	294	355	370	457	392	294	356	393	381	291
17	B		13	11	14	14	13	14	10	13	13	12	10
18			101	97	62	73	62	65	54	63	102	62	57
20			47	44	35	54	35	44	27	39	49	37	37
21			13	12	12	14	16	13	10	12	13	13	12
22			72	64	48	84	73	73	49	65	81	69	6
23			34	33	28	38	42	37	29	32	38	37	33
24	C		146	136	123	155	164	146	120	133	155	152	135
25			48	45	42	51	53	47	41	45	49	53	45
26	C		148	142	125	163	166	136	124	137	152	156	140
27			42	40	36	48	45	39	34	38	42	40	38
28	C		118	122	95	140	109	120	83	99	124	109	101
29			21	20	23	25	22	19	15	20	20	22	20
30	C		40	39	32	44	41	35	26	37	38	40	37
32	C		21	20	12	24	20	17	12	20	18	21	20
Monounsaturates													
16:1*n*-7	A		244	171	320	309	462	346	210	298	298	320	205
16:1*n*-5	A		48	40	45	46	74	59	37	47	52	51	40
18:1*n*-9	B		98	75	118	114	211	128	87	120	136	115	72
18:1*n*-7	B		160	116	153	151	282	190	120	175	186	165	126
20:1*n*-9	B		19	13	17	22	31	21	18	27	33	17	10
20:1*n*-7	B		14	10	26	19	28	23	13	15	20	12	12
22:1[1]	B		23	14	12	24	33	20	22	36	45	17	16
Polyunsaturates													
18:2			18	13	25	26	35	32	14	25	25	16	13
18:3			1	1	2	2	3	3	1	3	2	1	1
18:4*n*-3	A		15	11	15	15	31	21	12	19	21	16	9
20:2			14	4	10	8	27	15	7	12	16	10	9
20:4*n*-6	A		35	21	44	37	111	70	30	58	63	46	23
20:5*n*-3	A		41	22	53	48	98	72	37	69	85	56	25
22:6*n*-3	A		25	12	21	21	51	35	16	35	48	29	11
Branched													
i-15	B		41	33	42	40	53	44	38	40	41	45	33
ai-15	B		56	46	51	52	71	60	45	49	51	58	47
i-17	B		15	11	18	17	20	17	12	16	13	15	12
ai-17	B		17	14	17	17	19	18	15	17	17	16	12
Total			2201	1835	2150	2388	3109	2498	1763	2288	2557	2335	1750
Σ assigned to A			497	350	596	578	951	709	425	623	664	621	389
% assigned to A			23	19	28	24	31	28	24	27	26	27	22
Σ assigned to B			477	358	489	492	788	557	396	528	574	494	366
% assigned to B			22	19	23	21	25	22	22	23	22	21	21
Σ assigned to C			473	459	387	526	500	454	365	426	487	478	432
% assigned to C			21	25	18	22	16	18	21	19	19	20	25
16:1/16:0			0.8	0.7	1.0	1.0	1.2	1.0	0.8	1.0	0.9	1.0	0.8
18:1/18:0			2.6	2.0	4.4	3.6	7.9	4.9	3.9	4.7	3.2	4.5	3.5

[1] 22:1*n*-11+22:1*n*-9

Table 22 (continued)

Fatty Acid	assigned group	Station	57/098	57/100	57/101	57/102	57/104	57/105	59/064	59/066	59/068	59/070	59/072
		Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
n-Saturates													
14	A		76	70	91	113	75	85	71	66	64	85	90
15	B		18	16	20	27	16	19	17	16	14	20	22
16			275	257	343	420	280	320	276	240	235	324	330
17	B		11	10	12	15	10	13	10	9	9	12	13
18			50	56	62	71	60	65	56	47	53	62	68
20			35	50	34	51	57	43	43	34	27	50	46
21			11	12	11	17	13	12	11	10	10	13	12
22			59	77	58	91	83	64	64	54	47	78	69
23			33	33	30	46	33	29	29	27	26	32	31
24	C		132	139	120	192	143	124	124	107	104	140	131
25			46	46	37	61	47	40	40	35	36	43	43
26	C		138	144	118	186	148	130	123	108	109	139	137
27			40	42	33	53	43	37	34	30	29	40	39
28	C		111	115	75	160	124	94	101	88	73	139	119
29			19	21	14	26	22	19	17	14	16	21	18
30	C		35	39	26	47	41	34	32	24	27	38	34
32	C		18	20	12	24	21	18	16	12	13	18	18
Monounsaturates													
16:1*n*-7	A		187	155	312	361	158	243	163	143	156	219	225
16:1*n*-5	A		42	32	48	61	33	37	37	33	35	47	46
18:1*n*-9	B		70	65	124	135	74	102	81	66	68	106	117
18:1*n*-7	B		121	97	182	216	99	148	128	100	109	155	146
20:1*n*-9	B		8	9	18	33	13	32	12	10	14	17	21
20:1*n*-7	B		10	9	27	23	9	18	16	9	11	14	14
22:1[1]	B		13	13	22	42	18	49	14	13	25	15	20
Polyunsaturates													
18:2			12	13	27	28	18	23	18	14	15	23	26
18:3			1	1	2	2	1	2	1	1	1	2	2
18:4*n*-3	A		11	10	18	22	10	14	12	9	8	14	14
20:2			5	6	13	14	18	12	13	5	8	12	8
20:4*n*-6	A		20	19	60	74	29	37	23	21	20	35	34
20:5*n*-3	A		20	19	80	79	22	72	25	21	22	39	45
22:6*n*-3	A		13	10	36	53	14	46	17	12	13	23	33
Branched													
i-15	B		38	31	36	49	31	39	32	30	33	38	41
ai-15	B		50	39	45	62	40	42	41	37	39	49	52
i-17	B		11	10	17	20	10	26	11	10	14	17	16
ai-17	B		13	12	17	30	11	18	14	12	13	16	19
Total			1753	1696	2182	2904	1822	2102	1724	1466	1494	2097	2097
Σ assigned to A			369	314	645	761	340	534	348	305	319	461	486
% assigned to A			21	19	30	26	19	25	20	21	21	22	23
Σ assigned to B			365	311	520	653	331	505	377	312	347	459	482
% assigned to B			21	18	24	22	18	24	22	21	23	22	23
Σ assigned to C			434	456	352	609	476	398	396	340	326	475	439
% assigned to C			25	27	16	21	26	19	23	23	22	23	21
16:1/16:0			0.8	0.7	1.0	1.0	0.7	0.9	0.7	0.7	0.8	0.8	0.8
18:1/18:0			3.8	2.9	4.9	4.9	2.9	3.8	3.7	3.5	3.3	4.2	3.9

[1] 22:1*n*-11+22:1*n*-9

Table 22 (continued)

Fatty Acid	assigned group	Station	59/074	59/076	59/077	59/079	59/082	59/084	59/085	59/086	62/002	62/004	62/012
		Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ		MIZ	SOWZ	SOWZ	SOWZ
n-Saturates													
14	A		114	144	98	70	88	80	91	57	81	77	141
15	B		26	31	24	16	21	18	22	13	24	21	27
16			375	443	390	249	323	289	332	195	288	283	462
17	B		13	14	13	10	11	12	13	7	14	14	19
18			64	72	70	53	66	56	69	44	71	61	88
20			40	46	48	36	37	33	41	19	29	33	20
21			13	10	13	10	13	10	12	8	8	8	5
22			64	76	78	52	60	53	72	39	45	61	24
23			32	25	34	25	35	27	33	23	14	18	7
24	C		130	101	150	107	141	116	135	97	106	148	68
25			42	29	47	35	45	38	41	36	23	28	13
26	C		133	90	153	111	153	122	129	108	115	150	67
27			37	24	42	32	43	35	35	29	23	24	9
28	C		115	82	137	92	110	110	111	75	74	81	34
29			16	11	19	16	22	17	17	15	14	12	5
30	C		30	21	36	29	40	32	31	29	23	22	7
32	C		15	11	19	15	19	15	14	14	10	11	11
Monounsaturates													
16:1*n*-7	A		266	289	280	158	240	214	232	156	232	227	305
16:1*n*-5	A		53	65	59	34	51	46	53	32	63	68	61
18:1*n*-9	B		167	136	158	78	125	114	106	68	94	112	223
18:1*n*-7	B		210	193	230	109	198	164	176	121	205	208	361
20:1*n*-9	B		36	16	34	11	21	28	26	12	19	21	88
20:1*n*-7	B		21	15	26	8	20	17	14	10	8	10	28
22:1[1]	B		44	13	27	12	20	25	13	12	23	23	93
Polyunsaturates													
18:2			40	30	35	16	30	22	29	1	24	19	116
18:3			3	1	2	1	2	2	1	1	1	1	8
18:4*n*-3	A		19	17	17	11	15	15	15	9	17	15	49
20:2			26	10	29	6	16	17	17	12	19	12	99
20:4*n*-6	A		60	30	62	22	42	29	30	20	56	52	173
20:5*n*-3	A		64	35	61	30	46	51	69	37	78	50	361
22:6*n*-3	A		37	16	31	14	27	22	26	14	58	43	223
Branched													
i-15	B		45	65	49	33	41	37	40	30	62	60	54
ai-15	B		54	86	62	42	59	50	54	36	71	74	54
i-17	B		21	19	22	13	21	14	14	11	21	20	59
ai-17	B		23	22	26	14	20	17	17	13	24	21	27
Total			2451	2286	2581	1569	2221	1947	2129	1404	2037	2089	3392
Σ assigned to A			614	596	607	339	509	458	516	325	585	532	1314
% assigned to A			25	26	24	22	23	24	24	23	29	25	39
Σ assigned to B			661	609	671	346	556	497	495	334	565	584	1034
% assigned to B			27	27	26	22	25	26	23	24	28	28	30
Σ assigned to C			424	304	494	353	464	394	420	322	328	413	187
% assigned to C			17	13	19	22	21	20	20	23	16	20	6
16:1/16:0			0.9	0.8	0.9	0.8	0.9	0.9	0.9	1.0	1.0	1.0	0.8
18:1/18:0			5.9	4.6	5.5	3.5	4.9	5.0	4.1	4.3	4.2	5.2	6.7

[1] 22:1*n*-11+22:1*n*-9

Table 22 (continued)

Fatty Acid	assigned group	Station	62/015	62/017	62/020	62/021	62/026	62/027	62/028	62/029	62/035	62/038	62/041
		Zone	SOWZ	SOWZ	SOWZ	SOWZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
n-Saturates													
14	A		157	229	90	83	61	64	65	64	72	66	70
15	B		24	29	19	19	15	15	17	15	20	15	18
16			613	787	348	327	225	214	257	232	249	226	250
17	B		13	17	12	11	10	7	11	10	11	9	11
18			71	83	53	54	49	48	63	55	62	56	61
20			24	33	39	42	27	24	43	31	33	28	37
21			6	7	9	9	9	9	11	10	11	10	10
22			40	54	58	63	44	42	66	49	51	42	57
23			14	16	24	22	23	22	27	24	26	20	24
24	C		89	97	109	107	101	98	127	103	109	85	105
25			19	25	36	34	34	30	40	33	39	27	34
26	C		93	101	121	116	110	90	136	110	131	92	117
27			17	19	32	31	31	24	39	32	38	26	35
28	C		64	86	92	86	85	56	106	86	118	66	106
29			9	8	15	15	16	9	20	15	21	12	16
30	C		18	22	29	27	27	17	35	26	35	22	29
32	C		8	9	15	13	14	9	17	13	19	11	15
Monounsaturates													
16:1*n*-7	A		464	1185	223	184	155	156	182	167	221	104	211
16:1*n*-5	A		85	76	49	48	37	40	50	44	54	28	50
18:1*n*-9	B		177	233	128	107	80	75	104	78	118	60	105
18:1*n*-7	B		288	609	150	152	135	119	158	125	171	92	166
20:1*n*-9	B		49	52	36	20	18	19	20	16	37	10	22
20:1*n*-7	B		13	43	11	12	10	7	10	8	13	5	9
22:1[1]	B		63	55	46	23	19	20	13	14	35	11	23
Polyunsaturates													
18:2			52	86	39	37	17	11	19	13	19	8	18
18:3			5	16	5	2	1	1	1	0	1	0	1
18:4*n*-3	A		25	35	15	13	11	11	14	12	16	6	15
20:2			16	102	15	22	14	9	11	6	17	7	26
20:4*n*-6	A		74	279	44	64	36	23	33	22	33	6	31
20:5*n*-3	A		144	396	52	42	44	29	42	35	49	5	49
22:6*n*-3	A		55	118	34	29	28	25	30	22	46	3	32
Branched													
i-15	B		65	55	49	51	34	39	41	37	46	38	40
ai-15	B		72	65	51	54	42	47	52	49	61	49	57
i-17	B		21	33	12	16	12	14	14	12	20	12	14
ai-17	B		17	31	15	17	13	15	17	14	22	16	18
Total			2965	5087	2074	1957	1590	1438	1891	1582	2024	1271	1881
Σ assigned to A			1003	2317	507	464	372	348	416	366	491	217	458
% assigned to A			34	46	24	24	23	24	22	23	24	17	24
Σ assigned to B			803	1220	529	483	389	377	456	379	555	317	482
% assigned to B			27	24	25	25	24	26	24	24	27	25	26
Σ assigned to C			271	315	366	350	338	270	422	338	411	276	372
% assigned to C			9	6	18	18	21	19	22	21	20	22	20
16:1/16:0			0.9	1.6	0.8	0.7	0.9	0.9	0.9	0.9	1.1	0.6	1.0
18:1/18:0			6.6	10.1	5.3	4.8	4.4	4.0	4.1	3.7	4.7	2.7	4.5

[1] 22:1*n*-11+22:1*n*-9

Table 22 (continued)

Fatty Acid	assigned group	Station Zone	62/044 MIZ	62/046 MIZ	62/048 MIZ	62/050 MIZ	62/054 MIZ	62/056 MIZ	62/058 MIZ	64/487 CZ	64/488 CZ	64/489 ICZ	64/490 ICZ
n-Saturates													
14	A		68	64	80	70	73	67	64	333	159	101	141
15	B		18	15	19	18	18	18	15	26	17	19	27
16			280	240	286	253	272	247	246	934	489	421	623
17	B		10	10	13	10	10	10	9	12	9	11	17
18			93	59	61	56	57	44	48	72	44	56	85
20			36	46	40	33	45	27	33	15	20	27	32
21			10	10	11	11	12	11	10	3	3	6	7
22			56	65	59	55	71	50	53	20	28	38	54
23			26	22	26	28	31	29	26	7	6	12	9
24	C		117	102	111	113	132	119	112	41	47	74	68
25			38	30	35	39	42	40	36	11	9	21	16
26	C		134	102	114	122	132	119	112	42	50	89	68
27			39	30	31	36	37	33	32	10	10	19	13
28	C		109	79	93	94	95	81	87	33	38	61	46
29			20	14	16	17	17	15	16	5	5	10	6
30	C		34	26	28	30	31	24	29	12	12	20	15
32	C		18	14	13	16	15	11	15	4	5	11	7
Monounsaturates													
16:1*n*-7	A		202	156	211	183	174	176	154	2044	787	371	520
16:1*n*-5	A		53	34	46	39	41	41	40	53	52	70	86
18:1*n*-9	B		157	76	115	86	76	80	69	347	158	193	355
18:1*n*-7	B		174	116	180	133	129	136	117	380	164	219	334
20:1*n*-9	B		27	16	29	20	13	19	10	45	21	25	62
20:1*n*-7	B		15	9	19	8	9	10	9	43	12	14	23
22:1[1]	B		21	16	34	19	18	23	12	48	18	19	86
Polyunsaturates													
18:2			27	17	26	19	16	14	14	154	49	68	149
18:3			1	1	2	1	1	1	1	33	15	8	11
18:4*n*-3	A		14	10	15	11	11	12	11	55	26	20	35
20:2			23	20	37	11	9	9	5	36	9	28	58
20:4*n*-6	A		53	37	75	35	30	26	27	275	52	126	146
20:5*n*-3	A		55	43	68	52	29	26	26	619	180	132	220
22:6*n*-3	A		32	26	36	21	18	20	18	138	46	76	97
Branched													
i-15	B		40	3	46	38	38	38	33	45	47	64	81
ai-15	B		54	40	53	47	50	48	43	43	49	65	72
i-17	B		18	13	21	14	12	14	10	22	13	27	36
ai-17	B		19	16	21	15	15	14	12	21	13	19	29
Total			2092	1577	2069	1752	1780	1652	1551	5981	2661	2540	3632
Σ assigned to A			477	370	530	412	376	368	339	3517	1303	897	1244
% assigned to A			23	23	26	23	21	22	22	59	49	35	34
Σ assigned to B			553	330	550	407	388	410	339	1031	520	674	1121
% assigned to B			26	21	27	23	22	25	22	17	20	27	31
Σ assigned to C			412	324	361	374	404	355	354	134	153	254	205
% assigned to C			20	21	17	21	23	21	23	2	6	10	6
16:1/16:0			0.9	0.8	0.9	0.9	0.8	0.9	0.8	2.2	1.7	1.0	1.0
18:1/18:0			3.5	3.3	4.9	3.9	3.6	4.9	3.9	10.1	7.3	7.4	8.1

[1] 22:1*n*-11+22:1*n*-9

Table 22 (continued)

Fatty Acid	assigned group	Station	64/504	64/506	64/508	64/511	64/516	64/526	64/528	64/529	64/531	64/573	64/581
		Zone	ICZ	ICZ	ICZ	ICZ	ICZ	MIZ	ICZ	ICZ	ICZ	CZ	ICZ
n-Saturates													
14	A		86	55	71	111	274	68	72	70	96	357	100
15	B		17	14	16	21	35	16	17	16	21	17	17
16			355	245	295	549	927	263	269	264	371	874	446
17	B		10	8	9	14	12	10	9	8	11	8	11
18			54	42	47	78	76	56	50	47	62	69	54
20			34	32	35	26	20	39	36	31	53	22	24
21			9	8	8	5	5	11	10	11	12	5	7
22			49	48	50	33	31	58	55	51	77	31	38
23			19	23	19	9	9	25	25	26	29	7	12
24	C		89	97	85	59	55	114	104	112	124	56	65
25			27	33	29	16	14	33	32	36	38	13	19
26	C		96	109	98	69	65	112	100	112	119	60	79
27			24	30	26	15	13	30	27	30	31	11	18
28	C		71	82	69	51	47	80	90	92	88	42	56
29			12	14	14	7	8	14	13	14	16	7	10
30	C		22	28	24	17	16	25	25	29	29	13	19
32	C		11	13	13	8	7	11	12	13	15	7	10
Monounsaturates													
16:1*n*-7	A		321	148	181	434	1438	181	203	180	212	2218	432
16:1*n*-5	A		51	37	38	69	96	40	45	41	48	0	51
18:1*n*-9	B		135	103	90	358	366	78	84	66	103	167	224
18:1*n*-7	B		170	119	135	353	383	133	142	135	147	214	249
20:1*n*-9	B		26	13	17	86	52	16	12	9	13	29	36
20:1*n*-7	B		10	12	10	159	16	10	10	12	12	27	21
22:1[1]	B		11	6	10	35	27	9	6	7	9	21	34
Polyunsaturates													
18:2			38	26	28	130	108	16	17	15	28	138	93
18:3			2	1	2	11	26	1	1	1	1	13	7
18:4*n*-3	A		14	10	9	36	149	10	10	9	10	72	19
20:2			21	13	27	111	21	6	8	10	14	21	54
20:4*n*-6	A		70	58	87	356	39	34	41	44	43	25	121
20:5*n*-3	A		72	25	43	252	768	42	34	31	21	651	143
22:6*n*-3	A		30	17	30	144	211	28	23	21	12	101	63
Branched													
i-15	B		47	34	42	56	83	32	34	32	47	35	47
ai-15	B		56	40	48	55	71	46	48	47	60	52	52
i-17	B		17	14	19	31	32	14	15	11	18	18	29
ai-17	B		16	13	18	23	23	16	16	13	17	15	19
Total			2090	1569	1740	3787	5525	1678	1694	1649	2007	5415	2679
Σ assigned to A			644	350	458	1402	2975	403	428	396	442	3424	929
% assigned to A			31	22	26	37	54	24	25	24	22	63	35
Σ assigned to B			514	375	413	1191	1100	379	393	358	457	602	740
% assigned to B			25	24	24	31	20	23	23	22	23	11	28
Σ assigned to C			288	329	289	203	190	342	330	359	375	178	229
% assigned to C			14	21	17	5	3	20	19	22	19	3	9
16:1/16:0			1.0	0.8	0.7	0.9	1.7	0.8	0.9	0.8	0.7	2.5	1.1
18:1/18:0			5.7	5.3	4.8	9.2	9.9	3.7	4.5	4.3	4.0	5.5	8.7

[1] 22:1*n*-11+22:1*n*-9

Table 22 (continued)

Fatty Acid	assigned	Station	64/582	64/583	64/584	64/585	64/586	64/628	64/706	64/707	64/708	64/710
	group	Zone	ICZ	ICZ		ICZ	ICZ	MIZ	SOWZ	MIZ	MIZ	MIZ
n-Saturates												
14	A		63	57	78	92	59	62	75	64	57	54
15	B		13	12	16	21	13	13	20	15	10	12
16			288	239	355	357	228	235	328	241	216	200
17	B		8	6	7	11	7	7	11	7	6	7
18			42	33	40	59	41	43	61	37	28	40
20			20	23	32	49	31	29	44	30	20	35
21			5	7	12	13	10	10	11	8	5	10
22			32	34	52	72	49	49	67	45	27	53
23			10	17	23	33	26	25	26	24	13	25
24	C		51	72	111	133	102	103	114	100	54	106
25			13	26	33	43	33	35	33	36	18	37
26	C		55	82	110	132	99	108	112	117	62	121
27			12	24	32	37	28	31	29	32	17	34
28	C		36	64	95	111	73	81	83	86	43	90
29			6	12	12	18	12	14	14	16	8	17
30	C		12	23	27	34	24	26	28	28	15	31
32	C		7	11	13	17	12	13	14	13	7	16
Monounsaturates												
16:1*n*-7	A		201	148	160	226	134	155	212	139	170	94
16:1*n*-5	A		35	30	38	54	32	36	44	33	29	27
18:1*n*-9	B		135	95	75	117	62	68	96	65	85	42
18:1*n*-7	B		153	101	98	157	95	108	151	90	89	65
20:1*n*-9	B		32	25	12	15	7	15	17	8	20	6
20:1*n*-7	B		26	9	10	10	7	11	13	6	6	5
22:1[1]	B		26	21	8	10	2	10	8	3	18	2
Polyunsaturates												
18:2			47	24	16	26	13	16	29	16	22	10
18:3			3	2	1	2	0	1	1	1	1	1
18:4*n*-3	A		12	9	8	13	7	9	11	7	12	5
20:2			48	13	11	9	4	6	20	5	10	3
20:4*n*-6	A		131	50	38	43	23	32	66	28	41	18
20:5*n*-3	A		74	41	34	37	17	43	29	22	40	12
22:6*n*-3	A		49	23	21	21	9	32	16	9	20	6
Branched												
i-15	B		35	28	33	47	28	27	43	31	28	28
ai-15	B		40	35	52	63	39	35	52	38	34	35
i-17	B		20	11	10	15	9	11	20	11	11	10
ai-17	B		15	11	13	17	10	13	20	11	10	9
Total			1754	1419	1686	2113	1346	1511	1917	1420	1251	1264
Σ assigned to A			566	357	377	487	280	368	454	302	369	215
% assigned to A			32	25	22	23	21	24	24	21	29	17
Σ assigned to B			503	354	334	482	278	317	451	284	317	220
% assigned to B			29	25	20	23	21	21	24	20	25	17
Σ assigned to C			160	253	356	427	309	332	351	343	180	364
% assigned to C			9	18	21	20	23	22	18	24	14	29
16:1/16:0			0.8	0.7	0.6	0.8	0.7	0.8	0.8	0.7	0.9	0.6
18:1/18:0			6.9	5.9	4.3	4.7	3.8	4.1	4.1	4.2	6.2	2.7

[1] 22:1*n*-11+22:1*n*-9

Table 23 Concentrations (µg/g TOC) of Fatty Acids and Fatty Acid-Ratios in sea-ice sediments.

Fatty Acid	assigned group	Station	57/01-1	62/01-1	62/02-1	62/03-1	62/04-1	62/05-1	62/05-2	62/06-1	62/07-1
n-Saturates											
14	A		653	n.d.	288	3662	6486	4508	808	2926	1393
15	B		56	n.d.	52	268	303	236	75	228	97
16			2027	n.d.	818	9391	24891	12306	2423	9363	3814
17	B		21	n.d.	25	52	70	52	19	52	19
18			102	n.d.	109	341	658	359	102	565	89
20			90	n.d.	123	204	270	142	81	141	85
21			30	n.d.	28	67	54	33	31	43	36
22			182	n.d.	174	401	414	204	151	287	136
23			85	n.d.	62	144	116	69	80	108	52
24	C		434	n.d.	274	463	538	311	311	531	200
25			100	n.d.	63	128	74	62	86	100	57
26	C		332	n.d.	226	334	180	187	233	305	142
27			85	n.d.	55	95	39	44	54	84	44
28	C		227	n.d.	187	232	102	131	165	252	107
29			36	n.d.	28	44	24	26	31	55	23
30	C		81	n.d.	69	112	42	88	50	150	82
32	C		35	n.d.	29	75	20	18	22	74	23
Monounsaturates											
16:1*n*-7	A		6102	n.d.	1290	12584	30337	25796	8302	9210	10967
16:1*n*-5	A		33	n.d.	51	359	n.d.	487	46	224	143
18:1*n*-9	B		441	n.d.	167	3429	5074	2287	666	1951	636
18:1*n*-7	B		148	n.d.	59	438	701	387	142	387	85
20:1*n*-9	B		7	n.d.	7	53	88	31	3	36	6
20:1*n*-7	B		8	n.d.	10	29	35	22	19	22	20
22:1[1]	B		29	n.d.	23	75	235	119	23	52	30
Polyunsaturates											
18:2			135	n.d.	54	530	243	186	122	234	88
18:3			17	n.d.	9	222	166	63	73	27	100
18:4*n*-3	A		32	n.d.	31	662	411	290	72	126	126
20:2			4	n.d.	0	160	139	94	6	37	44
20:4*n*-6	A		4	n.d.	1	33	63	52	12	12	19
20:5*n*-3	A		233	n.d.	143	1625	3654	1455	749	383	842
22:6*n*-3	A		8	n.d.	19	389	334	105	77	25	86
Branched											
i-15	B		63	n.d.	75	88	139	98	83	113	33
ai-15	B		71	n.d.	73	235	323	109	72	121	39
i-17	B		64	n.d.	32	185	282	416	56	142	76
ai-17	B		25	n.d.	26	98	119	34	22	22	13
Total			11999	n.d.	4681	37203	76624	50808	15268	28389	19753
Σ assigned to A			7064	n.d.	1823	19314	41285	32693	10064	12906	13577
% assigned to A			59	n.d.	39	52	54	64	66	45	69
Σ assigned to B			933	n.d.	550	4949	7369	3792	1182	3125	1053
% assigned to B			8	n.d.	12	13	10	7	8	11	5
Σ assigned to C			1108	n.d.	784	1215	883	735	781	1313	554
% assigned to C			9	n.d.	17	3	1	1	5	5	3
16:1/16:0			3.0	n.d.	1.6	1.4	1.2	2.1	3.4	1.0	2.9
18:1/18:0			5.8	n.d.	2.1	11.3	8.8	7.4	7.9	4.1	8.1

[1] 22:1*n*-11+22:1*n*-9

Table 23 (continued)

Fatty Acid	assigned group	Station	62/07-2	62/08-1	62/08-2	62/08-3	62/09-1	62/10-1	64/02-1	64/05-1	64/11-1
n-Saturates											
14	A		3127	67	149	147	1052	489	3233	432	1538
15	B		237	11	21	19	79	55	250	40	133
16			22396	309	658	546	3338	1657	17977	1212	3658
17	B		50	9	16	15	21	16	56	13	31
18			358	52	86	86	133	75	318	56	128
20			196	51	63	105	76	74	101	59	124
21			59	15	24	36	34	22	30	25	53
22			269	73	102	166	166	103	172	104	212
23			135	29	40	77	68	40	58	45	109
24	C		489	95	144	233	263	183	266	164	357
25			122	5	14	27	70	47	52	46	98
26	C		278	19	35	75	206	162	137	117	246
27			74	3	6	12	58	42	33	29	82
28	C		174	11	19	43	150	130	89	73	186
29			31	2	3	7	28	23	19	16	39
30	C		67	8	11	21	55	70	67	35	84
32	C		25	5	9	13	17	34	18	10	39
Monounsaturates											
16:1*n*-7	A		13703	146	528	318	11778	4244	16094	2077	12645
16:1*n*-5	A		2188	20	33	49	n.d.	36	n.d.	70	217
18:1*n*-9	B		1344	592	1218	829	2302	353	963	326	653
18:1*n*-7	B		184	47	104	120	263	88	192	72	194
20:1*n*-9	B		12	10	21	4	15	5	14	5	8
20:1*n*-7	B		24	2	3	9	15	12	12	9	15
22:1[1]	B		66	6	10	15	37	15	26	15	64
Polyunsaturates											
18:2			92	274	586	493	200	72	81	51	217
18:3			167	4	12	12	103	36	37	13	124
18:4*n*-3	A		211	27	61	44	195	42	127	43	149
20:2			65	3	6	23	40	3	51	3	358
20:4*n*-6	A		27	4	8	6	23	6	7	5	22
20:5*n*-3	A		1256	56	109	81	1588	417	815	210	1510
22:6*n*-3	A		83	3	4	6	37	59	50	30	35
Branched											
i-15	B		49	32	64	67	47	59	58	54	104
ai-15	B		95	54	93	80	108	57	71	69	132
i-17	B		268	20	34	31	55	34	209	30	51
ai-17	B		33	31	56	51	63	17	23	11	33
Total			47954	2092	4349	3865	22682	8776	41706	5570	23649
Σ assigned to A			20594	322	893	651	14673	5292	20326	2866	16116
% assigned to A			43	15	21	17	65	60	49	51	68
Σ assigned to B			2363	814	1639	1239	3005	709	1875	644	1418
% assigned to B			5	39	38	32	13	8	4	12	6
Σ assigned to C			1032	137	217	385	691	579	577	398	912
% assigned to C			2	7	5	10	3	7	1	7	4
16:1/16:0			0.7	0.5	0.9	0.7	3.5	2.6	0.9	1.8	3.5
18:1/18:0			4.3	12.3	15.4	11.1	19.3	5.9	3.6	7.1	6.6

[1] 22:1*n*-11+22:1*n*-9

Table 24 Concentrations (μg/g TOC) of Sterols in marine sediments.

Sterol	assigned	Station	2616	2618	2619	2620	2622	2623	2624	2625	2626	2627	2628
	group	Zone	MIZ	CZ	CZ	CZ	CZ	CZ				MIZ	MIZ
$27^{5,22}$			50	112	n.d.	26	50	30	n.d.	317	n.d.	50	28
27^{5}			150	330	n.d.	75	242	76	n.d.	465	n.d.	89	62
$28^{5,22}$	A		53	193	n.d.	44	96	46	n.d.	271	n.d.	101	62
28^{5}	C		19	63	n.d.	12	37	21	n.d.	400	n.d.	26	15
$29^{5,22}$	C		15	65	n.d.	12	36	21	n.d.	51	n.d.	31	15
29^{5}	C		116	320	n.d.	65	146	76	n.d.	201	n.d.	152	109
Total			403	1083	n.d.	234	606	269	n.d.	1705	n.d.	450	291
Σ assigned to A			53	193	n.d.	44	96	46	n.d.	271	n.d.	101	62
% assigned to A			13	18	n.d.	19	16	17	n.d.	16	n.d.	23	21
Σ assigned to C			150	448	n.d.	89	218	118	n.d.	652	n.d.	209	138
% assigned to C			37	41	n.d.	38	36	44	n.d.	38	n.d.	46	47

Sterol	assigned	Station	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2640
	group	Zone	MIZ	ICZ	CZ	CZ	CZ	CZ			CZ	CZ	CZ
$27^{5,22}$			36	67	53	50	193	127	n.d.	130	51	24	113
27^{5}			130	237	181	252	401	452	n.d.	350	122	75	743
$28^{5,22}$	A		51	107	68	87	237	144	n.d.	213	105	42	213
28^{5}	C		13	25	25	21	65	26	n.d.	55	26	22	66
$29^{5,22}$	C		15	24	20	20	76	37	n.d.	73	23	15	79
29^{5}	C		93	126	100	119	379	210	n.d.	319	145	80	354
Total			339	587	448	548	1350	996	n.d.	1140	473	260	1568
Σ assigned to A			51	107	68	87	237	144	n.d.	213	105	42	213
% assigned to A			15	18	15	16	18	14	n.d.	19	22	16	14
Σ assigned to C			121	176	146	160	520	274	n.d.	446	194	118	499
% assigned to C			36	30	33	29	38	27	n.d.	39	41	45	32

Sterol	assigned	Station	2641	2642	2643	2644	2645	2646	2647	2648	2651	2654	2656
	group	Zone		CZ	CZ		SOWS	SOWS	SOWS	CZ	CZ	CZ	SOWS
$27^{5,22}$			61	121	219	450	60	51	37	232	147	48	35
27^{5}			273	351	619	1231	185	124	122	779	260	129	47
$28^{5,22}$	A		66	164	350	1308	155	94	77	300	267	92	66
28^{5}	C		31	31	78	130	21	14	13	116	59	11	8
$29^{5,22}$	C		17	52	151	185	30	17	16	56	120	29	18
29^{5}	C		76	282	683	659	140	106	98	261	430	115	65
Total			524	1000	2100	3962	589	407	364	1743	1284	423	240
Σ assigned to A			66	164	350	1308	155	94	77	300	267	92	66
% assigned to A			13	16	17	33	26	23	21	17	21	22	28
Σ assigned to C			124	365	913	973	190	138	128	433	609	155	91
% assigned to C			24	36	43	25	32	34	35	25	47	37	38

Sterol	assigned	Station	57/066	57/067	57/068	57/069	57/070	57/075	57/076	57/077	57/080	57/082	57/083
	group	Zone	ICZ	ICZ		ICZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
$27^{5,22}$			81	14	19	35	48	34	58	57	24	36	29
27^{5}			295	63	44	85	90	97	99	90	71	103	49
$28^{5,22}$	A		163	26	43	64	87	52	104	86	44	58	54
28^{5}	C		39	5	10	14	15	13	24	19	10	14	12
$29^{5,22}$	C		45	8	15	15	28	12	38	36	10	15	13
29^{5}	C		166	43	82	92	158	76	198	167	75	101	84
Total			790	158	213	304	427	285	521	456	235	327	241
Σ assigned to A			163	26	43	64	87	52	104	86	44	58	54
% assigned to A			21	16	20	21	20	18	20	19	19	18	23
Σ assigned to C			251	56	107	121	201	101	260	222	95	130	109
% assigned to C			32	35	50	40	47	36	50	49	41	40	45

Table 24 (continued)

Sterol	assigned group	Station	57/084	57/085	57/087	57/088	57/090	57/091	57/092	57/093	57/094	57/095	57/097
		Zone	MIZ	MIZ	ICZ	MIZ	MIZ		MIZ	MIZ	MIZ	MIZ	MIZ
$27^{5,22}$			35	32	25	51	48	n.d.	26	29	58	39	26
27^{5}			69	59	42	89	76	n.d.	53	51	110	90	39
$28^{5,22}$	A		73	70	54	98	103	n.d.	50	57	113	69	44
28^{5}	C		11	11	11	16	23	n.d.	10	12	25	15	10
$29^{5,22}$	C		25	21	12	31	23	n.d.	12	13	38	14	11
29^{5}	C		126	108	75	172	138	n.d.	77	85	167	82	67
Total			338	302	219	458	411	n.d.	228	247	510	309	197
Σ assigned to A			73	70	54	98	103	n.d.	50	57	113	69	44
% assigned to A			21	23	25	21	25	n.d.	22	23	22	22	22
Σ assigned to C			162	140	98	220	184	n.d.	99	111	230	111	88
% assigned to C			48	46	45	48	45	n.d.	44	45	45	36	45

Sterol	assigned group	Station	57/098	57/100	57/101	57/102	57/104	57/105	59/064	59/066	59/068	59/070	59/072
		Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
$27^{5,22}$			34	28	38	86	40	63	39	51	21	56	40
27^{5}			57	54	103	143	73	165	82	80	40	92	136
$28^{5,22}$	A		81	69	69	167	81	102	86	83	42	86	52
28^{5}	C		11	8	16	42	12	26	12	23	7	20	14
$29^{5,22}$	C		28	21	14	58	27	22	28	18	10	44	11
29^{5}	C		131	101	97	229	153	133	144	107	53	174	85
Total			343	280	336	725	387	511	391	362	174	472	338
Σ assigned to A			81	69	69	167	81	102	86	83	42	86	52
% assigned to A			24	25	20	23	21	20	22	23	24	18	15
Σ assigned to C			171	129	127	329	193	181	184	147	71	238	110
% assigned to C			50	46	38	45	50	36	47	41	41	50	32

Sterol	assigned group	Station	59/074	59/076	59/077	59/079	59/082	59/084	59/085	59/086	62/002	62/004	62/012
		Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ		MIZ	SOWZ	SOWZ	SOWZ
$27^{5,22}$			47	54	73	40	36	41	n.d.	53	68	41	71
27^{5}			72	95	130	83	85	63	n.d.	140	633	139	252
$28^{5,22}$	A		94	99	145	74	62	77	n.d.	68	85	69	96
28^{5}	C		18	18	30	13	12	15	n.d.	19	36	15	26
$29^{5,22}$	C		33	36	52	29	14	31	n.d.	14	19	20	31
29^{5}	C		154	173	240	157	91	139	n.d.	98	160	98	136
Total			419	474	670	396	300	366	n.d.	393	1000	383	613
Σ assigned to A			94	99	145	74	62	77	n.d.	68	85	69	96
% assigned to A			23	21	22	19	21	21	n.d.	17	9	18	16
Σ assigned to C			205	227	322	199	117	185	n.d.	131	214	133	193
% assigned to C			49	48	48	50	39	50	n.d.	33	21	35	31

Sterol	assigned group	Station	62/015	62/017	62/020	62/021	62/026	62/027	62/028	62/029	62/035	62/038	62/041
		Zone	SOWZ	SOWZ	SOWZ	SOWZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ
$27^{5,22}$			52	89	32	41	39	31	50	33	45	61	49
27^{5}			204	247	69	118	105	101	115	87	108	153	112
$28^{5,22}$	A		79	120	67	76	68	39	82	46	80	74	57
28^{5}	C		32	32	16	16	14	12	13	12	10	17	13
$29^{5,22}$	C		23	22	15	13	23	8	31	9	26	27	11
29^{5}	C		117	161	88	95	124	66	155	68	140	147	82
Total			507	671	287	359	373	257	446	254	408	479	324
Σ assigned to A			79	120	67	76	68	39	82	46	80	74	57
% assigned to A			16	18	23	21	18	15	18	18	20	15	18
Σ assigned to C			172	215	119	124	161	86	199	89	175	191	106
% assigned to C			34	32	41	35	43	33	45	35	43	40	33

Table 24 (continued)

Sterol	assigned	Station	62/044	62/046	62/048	62/050	62/054	62/056	62/058	64/487	64/488	64/489	64/490
	group	Zone	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	MIZ	CZ	CZ	ICZ	ICZ
$27^{5,22}$			46	44	55	29	34	50	35	82	29	51	90
27^{5}			58	123	111	57	74	96	81	205	74	106	233
$28^{5,22}$	A		80	71	102	49	92	71	57	107	47	95	172
28^{5}	C		12	17	18	11	13	18	13	46	17	24	52
$29^{5,22}$	C		32	27	36	10	30	14	12	35	18	28	50
29^{5}	C		148	155	167	81	154	100	78	160	73	122	202
Total			376	437	487	237	398	349	276	634	258	424	800
Σ assigned to A			80	71	102	49	92	71	57	107	47	95	172
% assigned to A			21	16	21	21	23	20	21	17	18	22	21
Σ assigned to C			192	199	220	102	198	132	102	241	108	173	305
% assigned to C			51	46	45	43	50	38	37	38	42	41	38

Sterol	assigned	Station	64/504	64/506	64/508	64/511	64/516	64/526	64/528	64/529	64/531	64/573	64/581
	group	Zone	ICZ	ICZ	ICZ	ICZ	ICZ	MIZ	ICZ	ICZ	ICZ	CZ	ICZ
$27^{5,22}$			48	28	28	74	58	70	45	51	47	53	71
27^{5}			98	56	53	171	196	106	117	101	74	119	225
$28^{5,22}$	A		101	67	70	149	85	107	87	98	104	77	125
28^{5}	C		19	9	17	38	25	26	17	14	16	26	38
$29^{5,22}$	C		27	19	26	35	26	37	24	26	29	28	33
29^{5}	C		155	106	124	156	103	131	132	125	148	109	164
Total			449	286	319	622	494	475	422	416	418	411	656
Σ assigned to A			101	67	70	149	85	107	87	98	104	77	125
% assigned to A			23	24	22	24	17	22	21	24	25	19	19
Σ assigned to C			202	134	167	228	154	193	174	165	194	162	235
% assigned to C			45	47	52	37	31	41	41	40	46	40	36

Sterol	assigned	Station	64/582	64/583	64/584	64/585	64/586	64/628	64/706	64/707	64/708	64/710
	group	Zone	ICZ	ICZ		ICZ	ICZ	MIZ	SOWZ	MIZ	MIZ	MIZ
$27^{5,22}$			78	31	21	38	27	54	32	31	22	20
27^{5}			188	102	4588	63	52	101	101	101	52	44
$28^{5,22}$	A		142	67	683	81	58	98	60	61	53	44
28^{5}	C		36	14	62	16	10	24	15	14	7	6
$29^{5,22}$	C		36	24	34	26	18	31	26	25	20	15
29^{5}	C		198	99	192	131	101	117	102	107	89	71
Total			679	337	5581	356	265	424	336	338	244	199
Σ assigned to A			142	67	683	81	58	98	60	61	53	44
% assigned to A			21	20	12	23	22	23	18	18	22	22
Σ assigned to C			270	137	289	174	129	172	143	145	116	92
% assigned to C			40	41	5	49	49	41	42	43	48	46

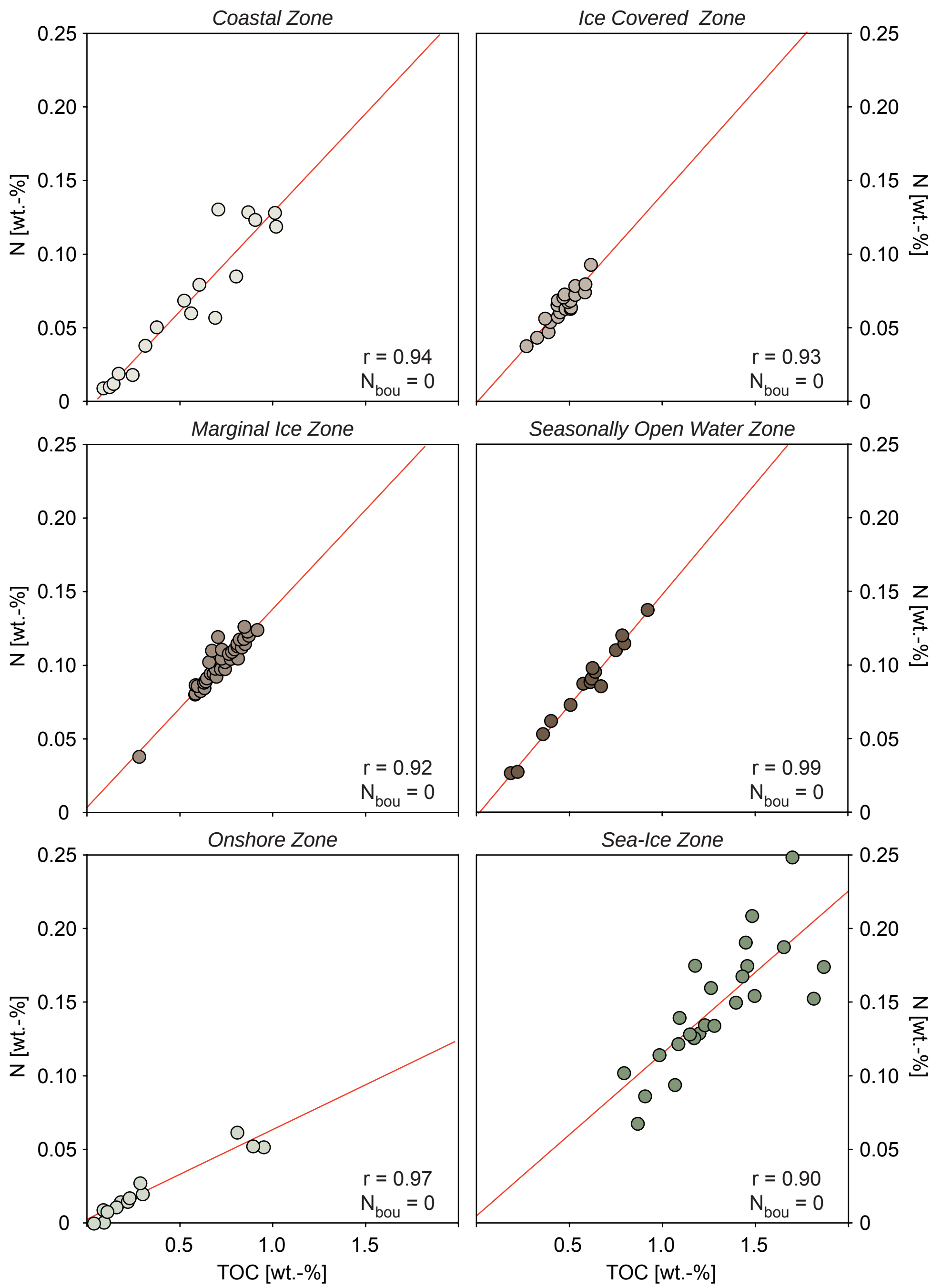


Figure B1 Estimations of the inorganic nitrogen contents (N_{bou} in wt.-%) for samples of different zones using plots of total nitrogen (N in wt.-%) versus TOC (wt.-%) (see Chapter 3.1.1). Red lines are regression lines (r=correlation coefficient).

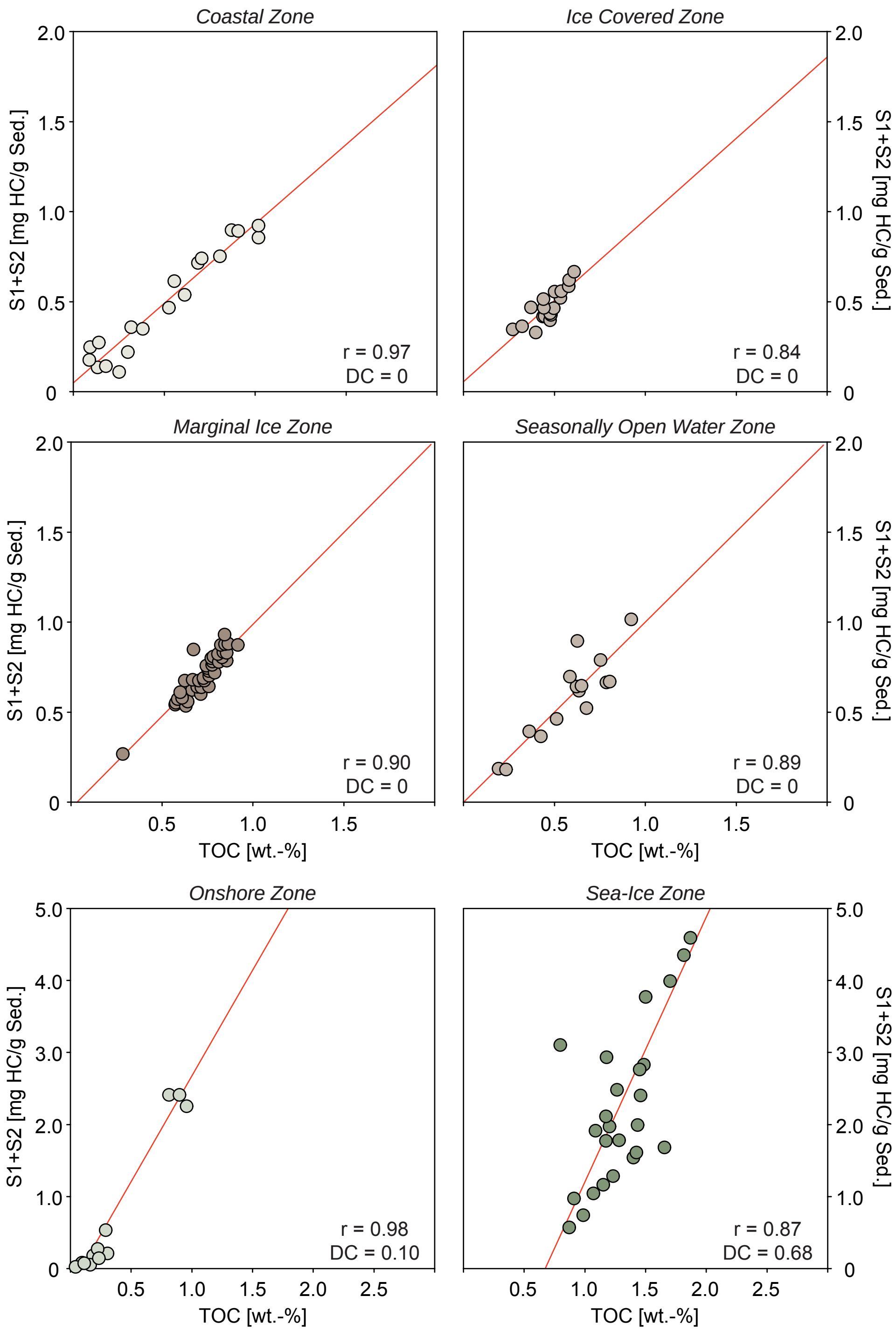


Figure B2 Estimations of the "dead carbon" contents (DC in wt.-%) for samples of different zones using plots of genetic potential (S1+S2 in mg HC/g Sed.) versus TOC (in wt.-%). (Chapter 3.1.2).Red lines are regression lines (r=correlation coefficient).

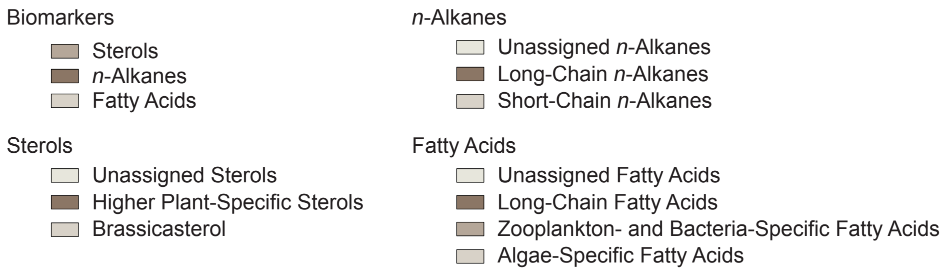


Figure B3 Legend for Figures B4 to B7.

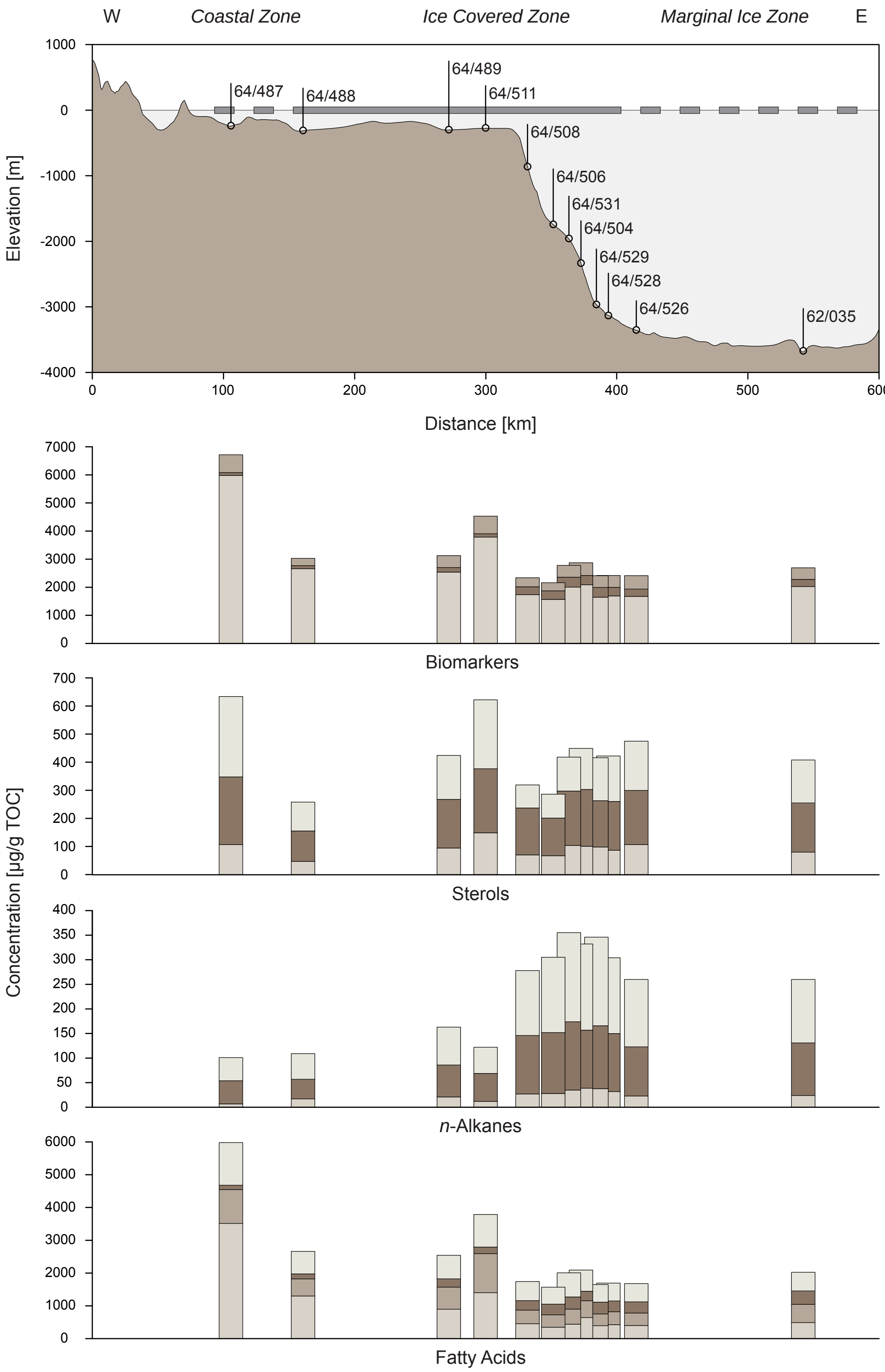


Figure B4 Transect I across the East Greenland continental margin with concentrations of biomarkers, sterols, *n*-alkanes and fatty acids (in µg/g TOC). For location of transect and legend see Figure 6.1 and Figure B4, respectively.

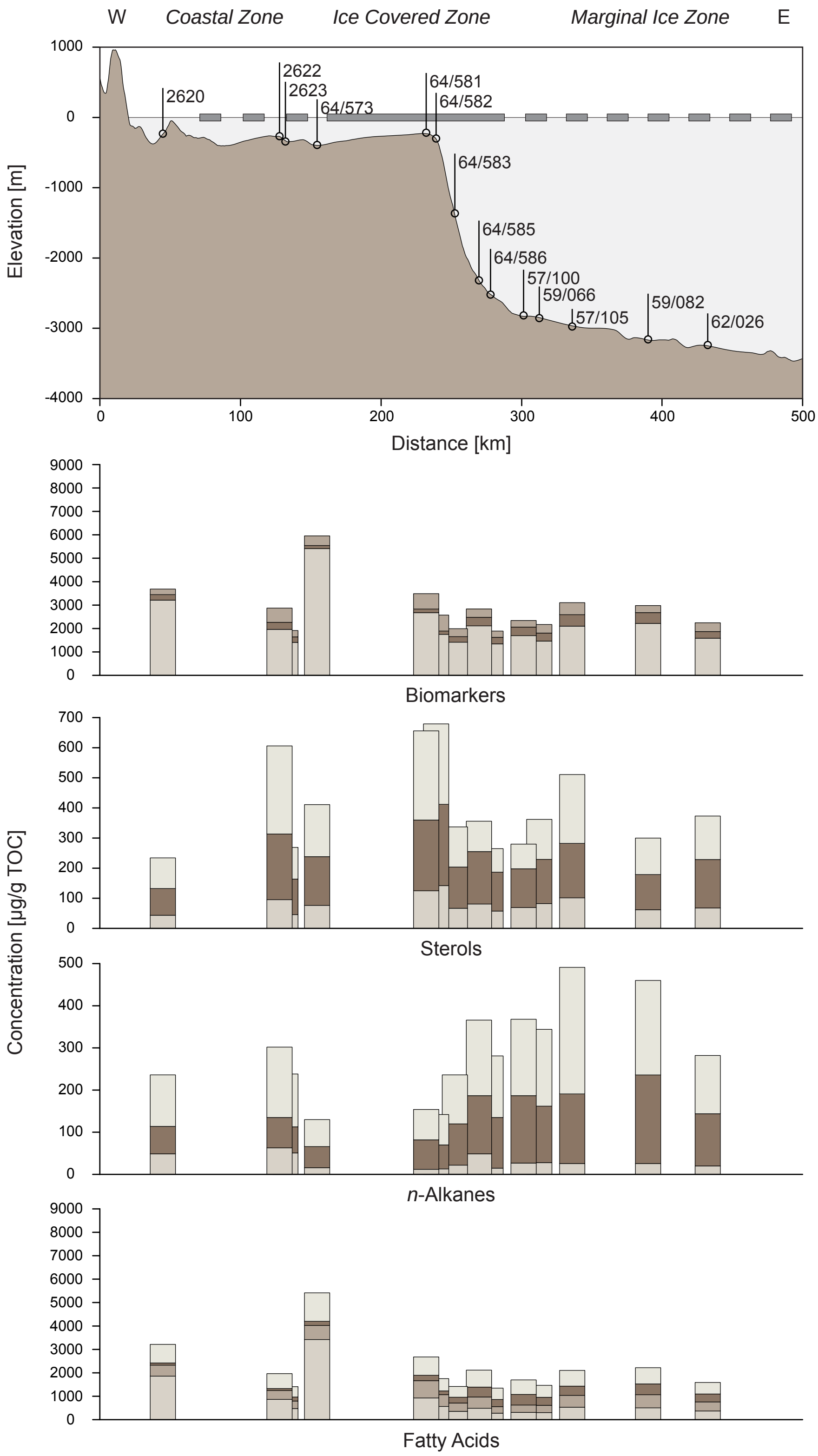


Figure B5 Transect II across the East Greenland continental margin with concentrations of biomarkers, sterols, *n*-alkanes and fatty acids (in µg/g TOC). For location of transect and legend see Figure 6.1 and Figure B4, respectively.

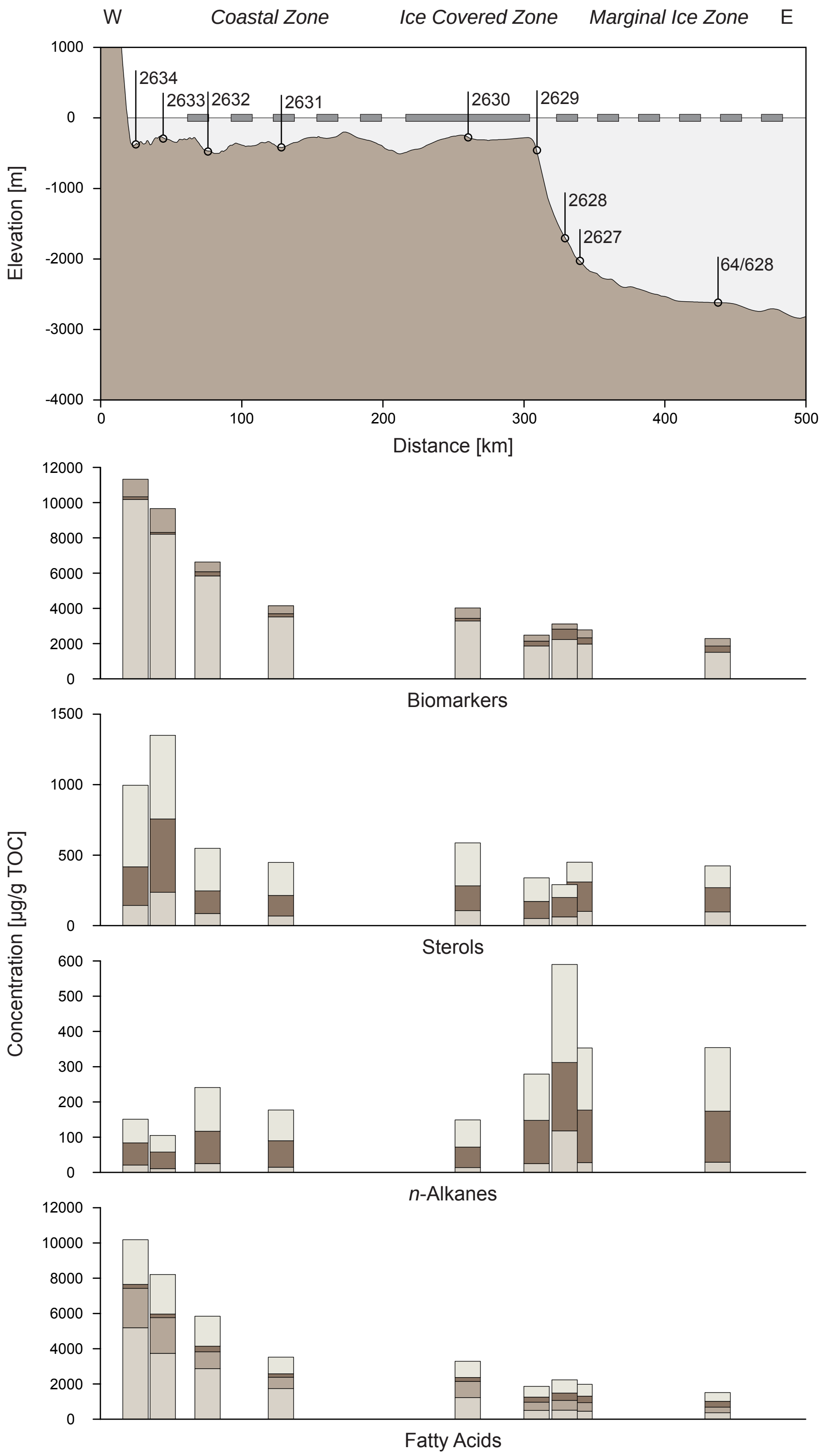


Figure B6 Transect III across the East Greenland continental margin with concentrations of biomarkers, sterols, *n*-alkanes and fatty acids (in µg/g TOC). For location of transect and legend see Figure 6.1 and Figure B4, respectively.

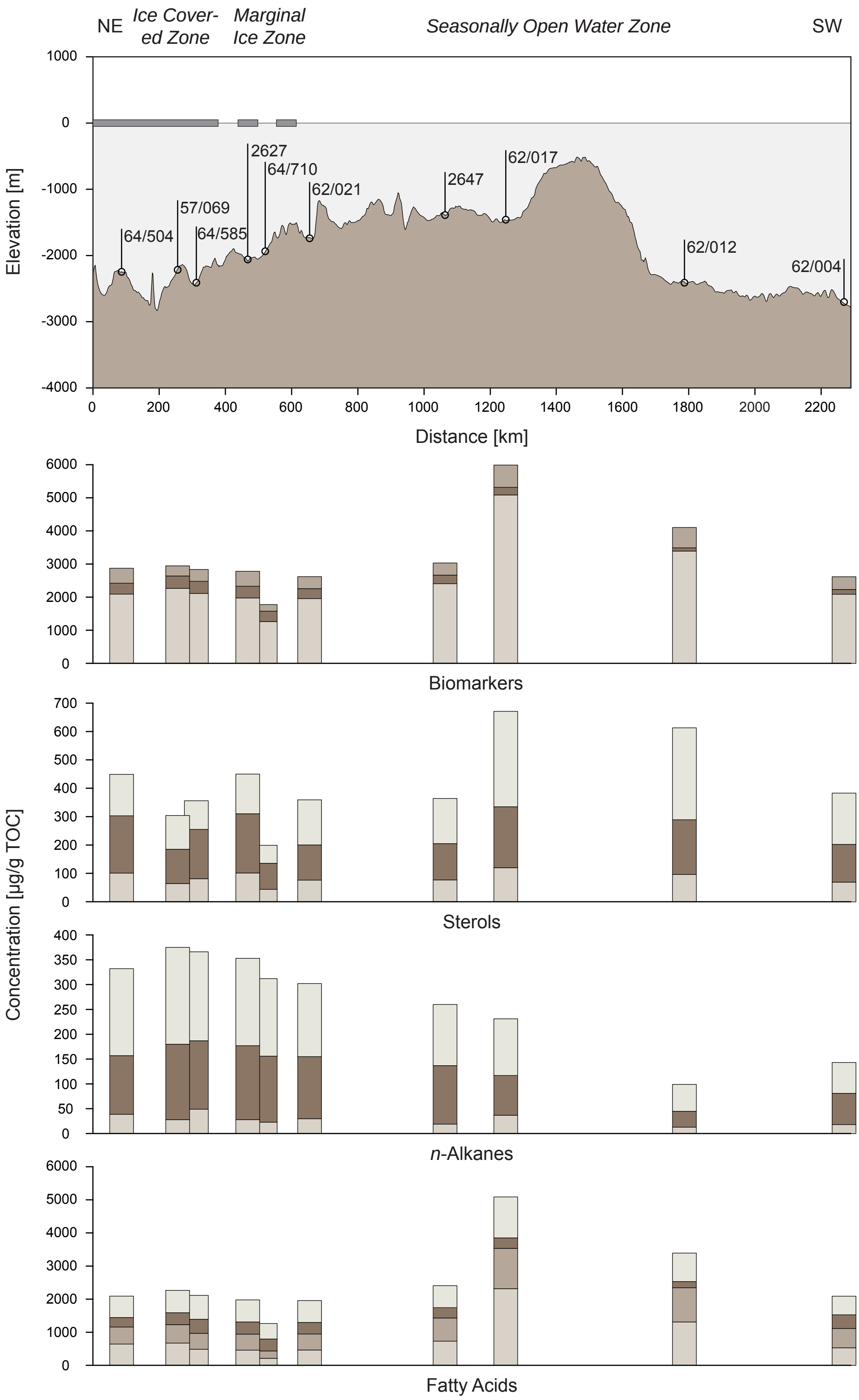
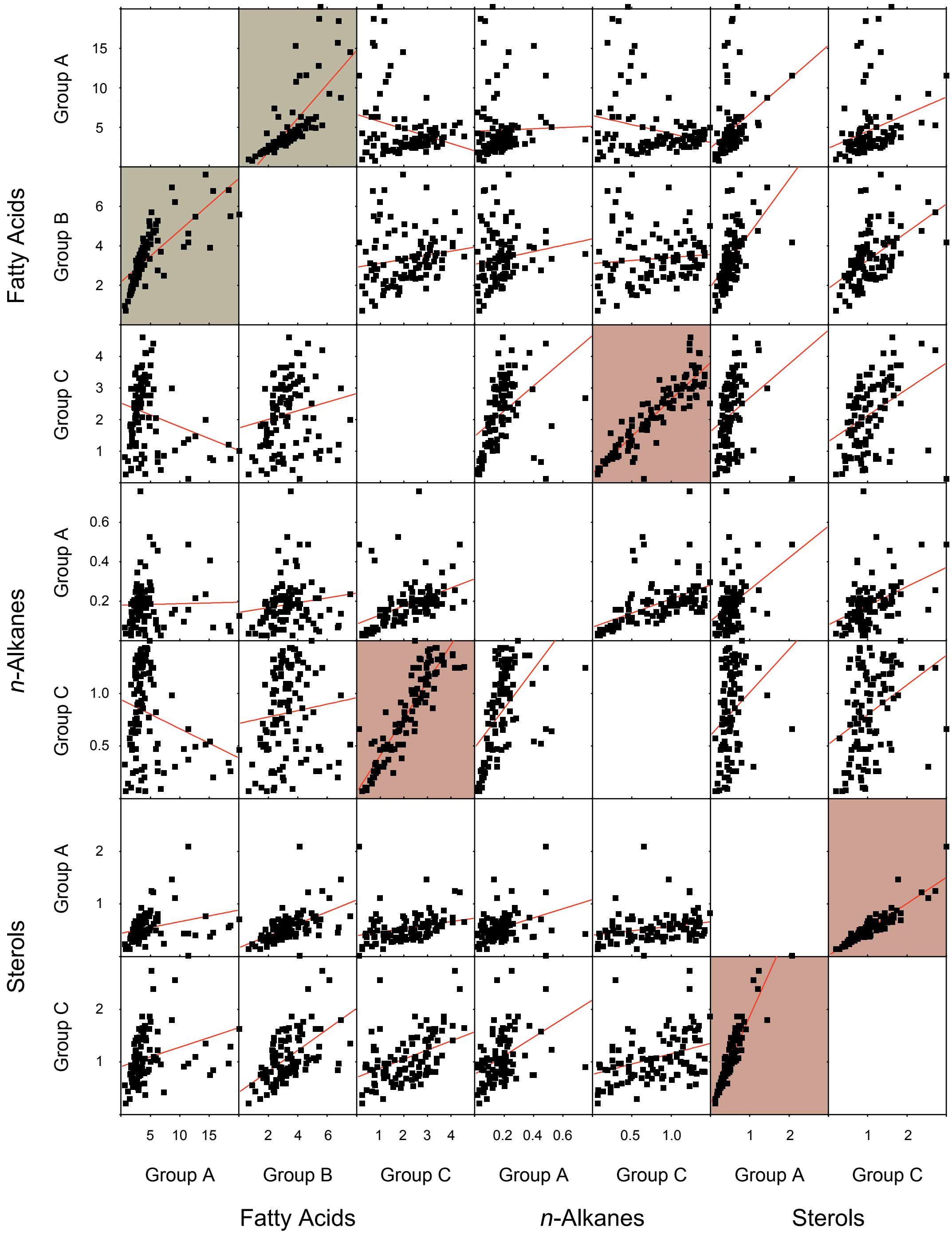


Figure B7 Transect IV along the East Greenland continental margin with concentrations of biomarkers, sterols, *n*-alkanes and fatty acids (in µg/g TOC). For location of transect and legend see Figure 6.1 and Figure B4, respectively.



		Fatty Acids			*n*-Alkanes		Sterols	
		Group A	Group B	Group C	Group A	Group C	Group A	Group C
Fatty Acids	Group A		0.75	-0.26	0.02	-0.25	0.31	0.28
	Group B	0.75		0.17	0.14	0.10	0.56	0.53
	Group C	-0.26	0.17		0.43	0.90	0.27	0.38
n-Alkanes	Group A	0.02	0.14	0.43		0.52	0.37	0.41
	Group C	-0.25	0.10	0.90	0.52		0.26	0.33
Sterols	Group A	0.31	0.56	0.27	0.37	0.26		0.91
	Group C	0.28	0.53	0.38	0.41	0.33	0.91	

Figure B8 Correlation matrix and correlation coefficients of evaluated biomarkers in marine samples. Coloured boxes indicating high positive correlation.

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Erklärung

Hiermit versichere ich, dass ich

1. die Arbeit ohne unerlaubte fremde Hilfe angefertigt habe,

2. keine anderen als die von mir angegebenen Quellen und Hilfsmittel benutzt habe und

3. die den benutzten Werken wörtlich oder inhaltlich entnommenen Stellen als solche kenntlich gemacht habe.

Bremerhaven, den 18.04.2006

(Unterschrift)