Investigation of the North Atlantic Heinrich events using molecular approach

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Volume II: Figures and Appendices

University
of Durham

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Figure 1.1 Potential locations of major ice streams in northern hemisphere ice sheets (adapted from Stokes & Clark, 2001). Light blue - IRD belt (area containing Heinrich Layers) (Ruddiman, 1977). Dark blue- major debris flows deposits (Aksu & Piper, 1987; Vorren & Laberg, 1997; O'Cofaigh *et al.*, 2003).

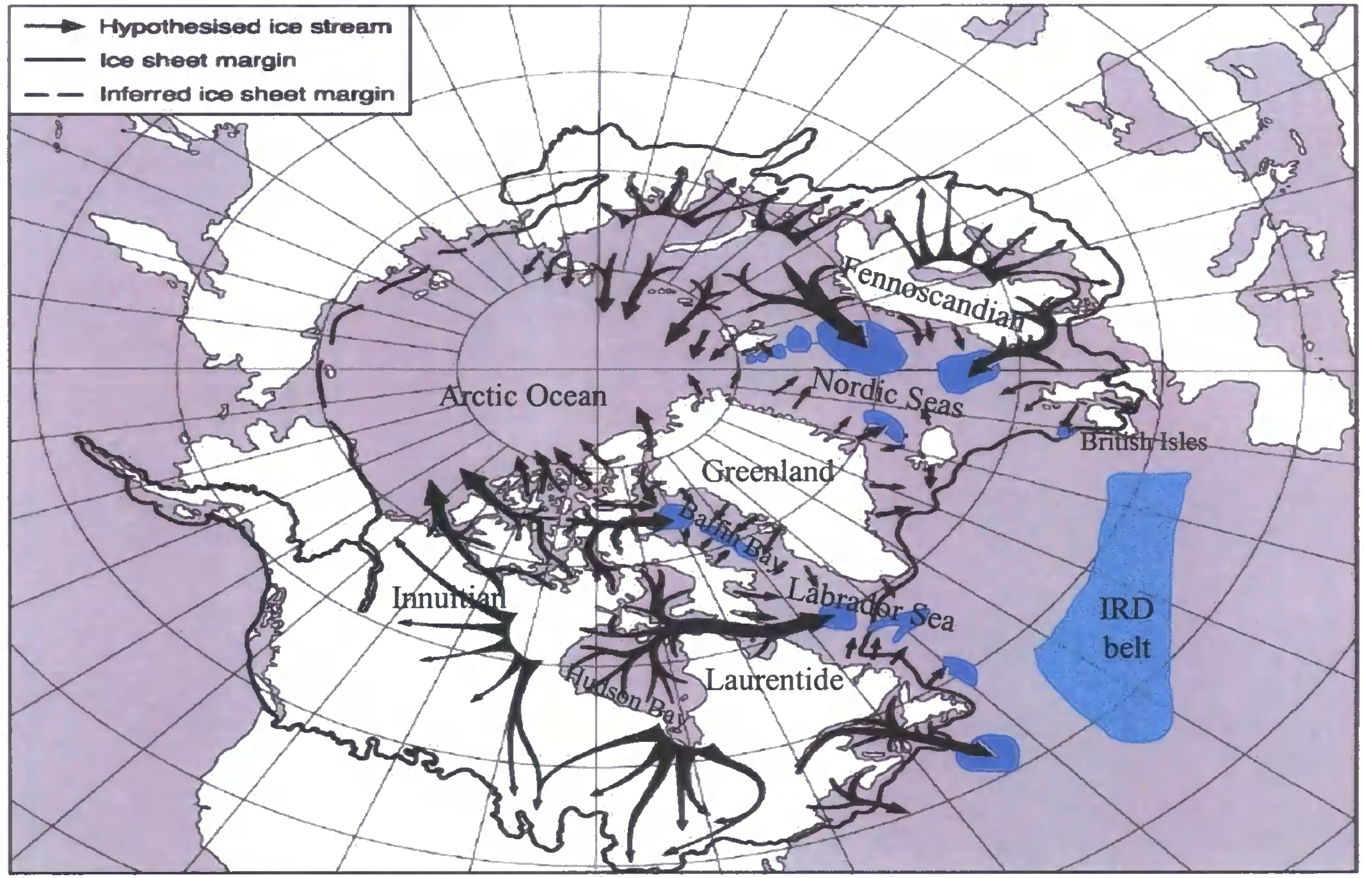


Figure 1.2 Simplified scheme of Trough mouth fan and Heinrich Layer formation. After Voren & Laberg (1995).

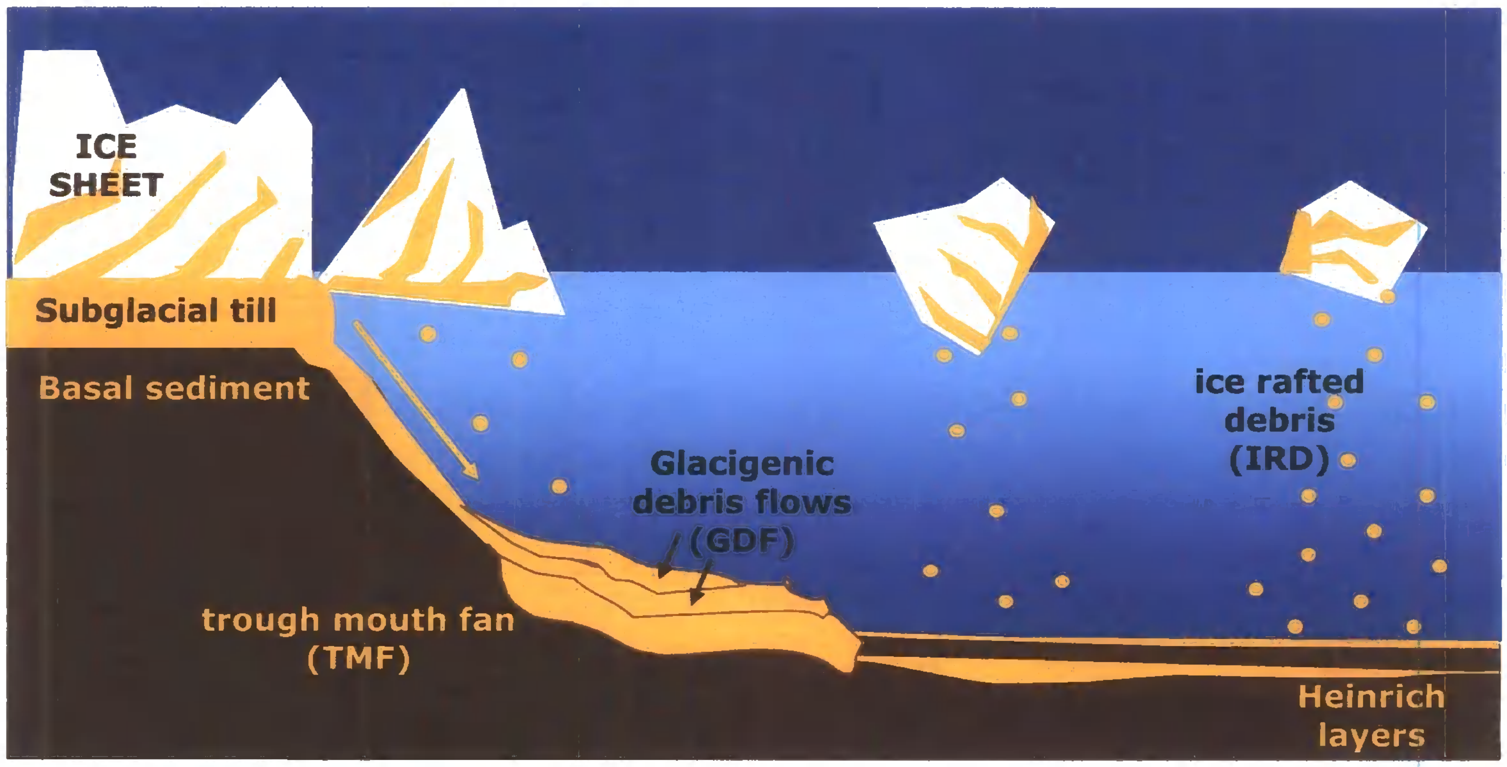


Figure 2.1 Overview of the methods

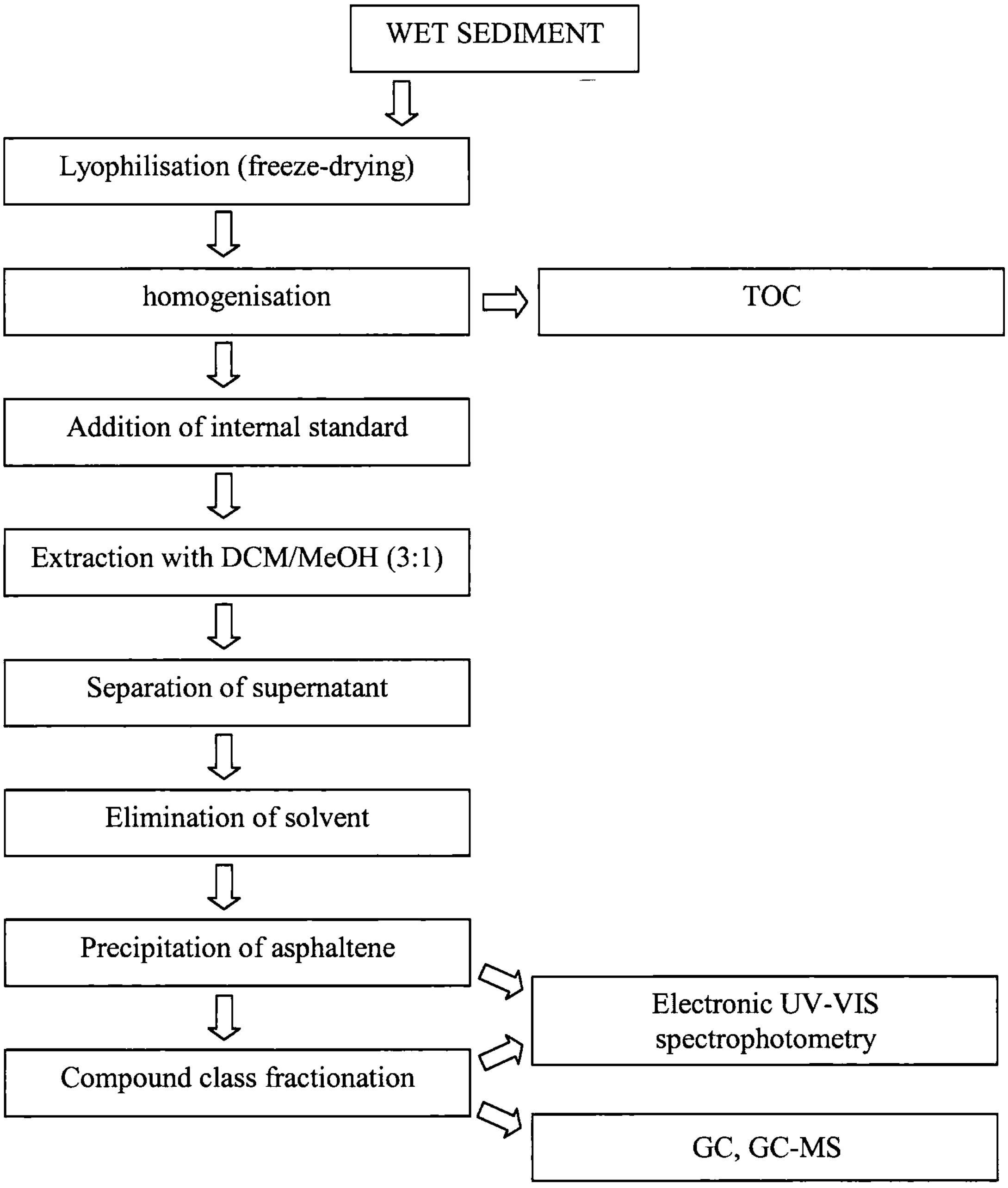


Figure 2.2 Relative yield of pigments in screening factorial design normalised to the highest value (at 80°C, 16 ml solvent and 5 minutes extraction time). Empty bars represent response at low temperature, shaded bars - at high temperature, and patterned bars- ultrasonic extraction (three rounds (US) and one round (USx1)).

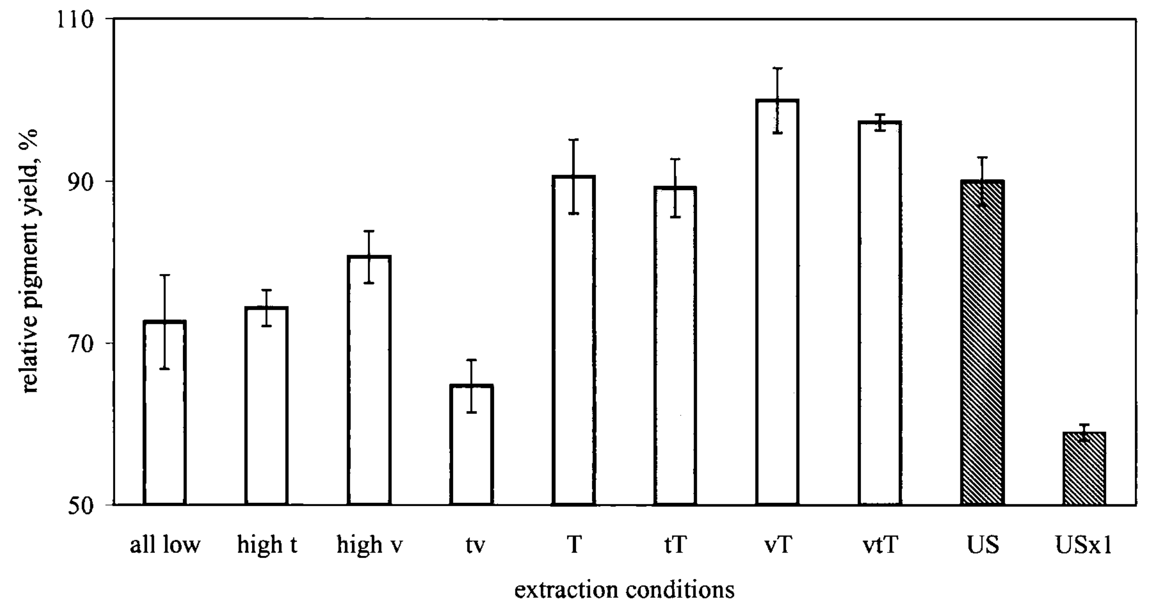


Figure 2.3 Representation of the standardised main effects in the factorial design including two- and three-factor interactions. Dotted vertical line indicates the statistical significance bound for the effects - tabulated F_{crit} =6.115 (at 95% confidence level) (Miller & Miller, 1993. p.223)

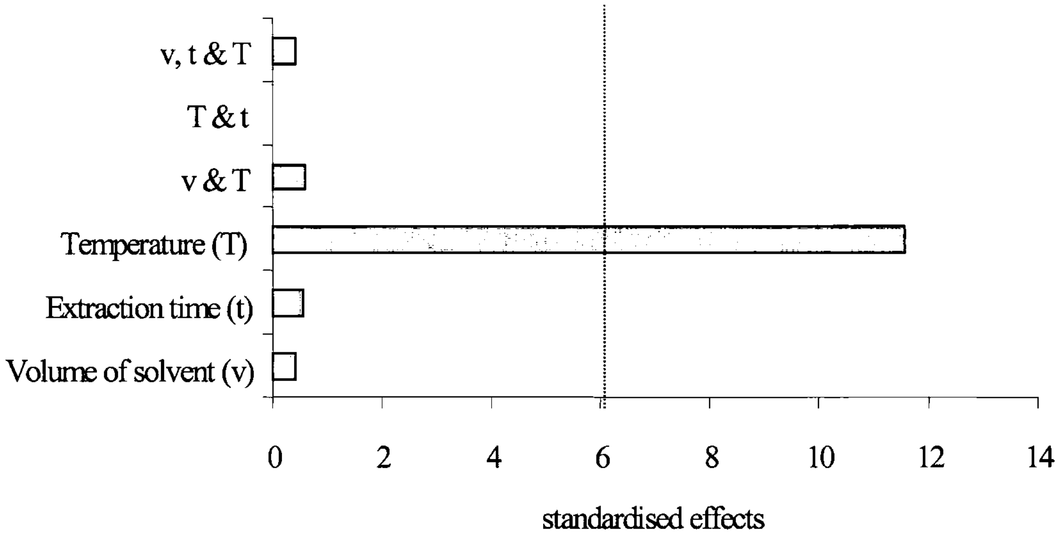


Figure 2.4 Relative yield of biomarkers (O & dashed line - $C_{37:2}+C_{37:3}$ alkenones, ◆ & solid line - pigments) using ultrasonic extraction (US) and microwave assisted extraction (MAE) at different temperatures, normalised to MAE at 70°C for alkenones and at 110°C for pigments

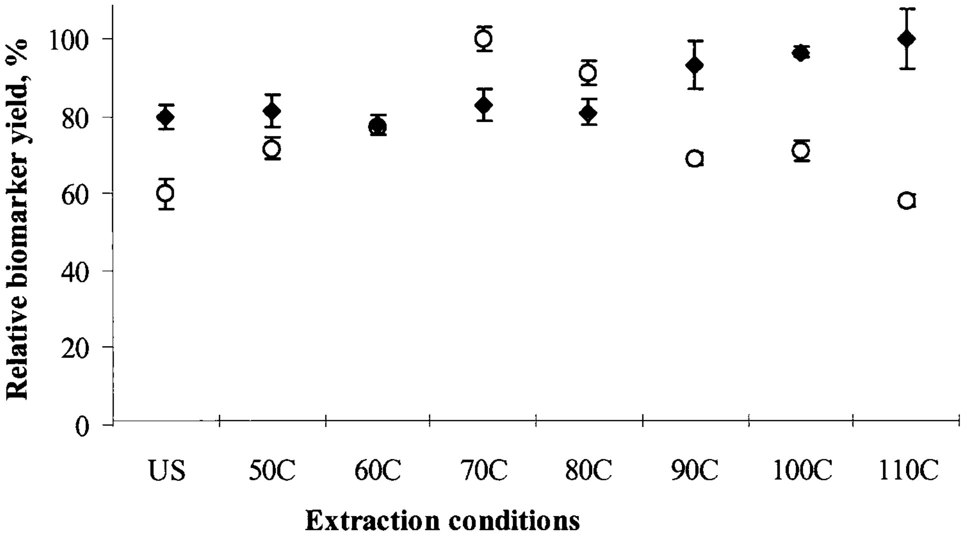


Figure 2.5 U^{K}_{37}' plotted against extraction conditions - sonication (US) and MAE at different temperatures.

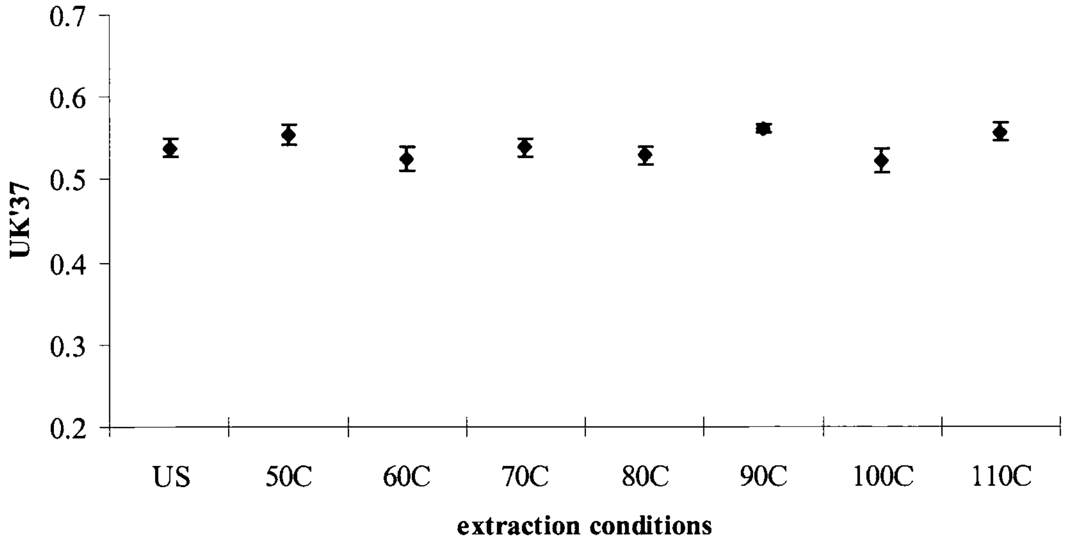


Figure 3.1 Core locations of Glacigenic Debris Flows samples. SSF – Scoresby Sund Fan (Dowdeswell *et al.*, 2000), BIF – Bear Island Fan (Dowdeswell *et al.*, 2000), NSF – North Sea Fan (King *et al.*, 1998), LS – Labrador Sea (Hesse *et al.*, 1990), BB - Baffin Bay (Aksu and Piper, 1987), ODP986 – Svalbard (Jansen *et al.*, 1996). Grey lines – rough outline of the glacigenic debris flows deposits (Vorren & Laberg, 1997).

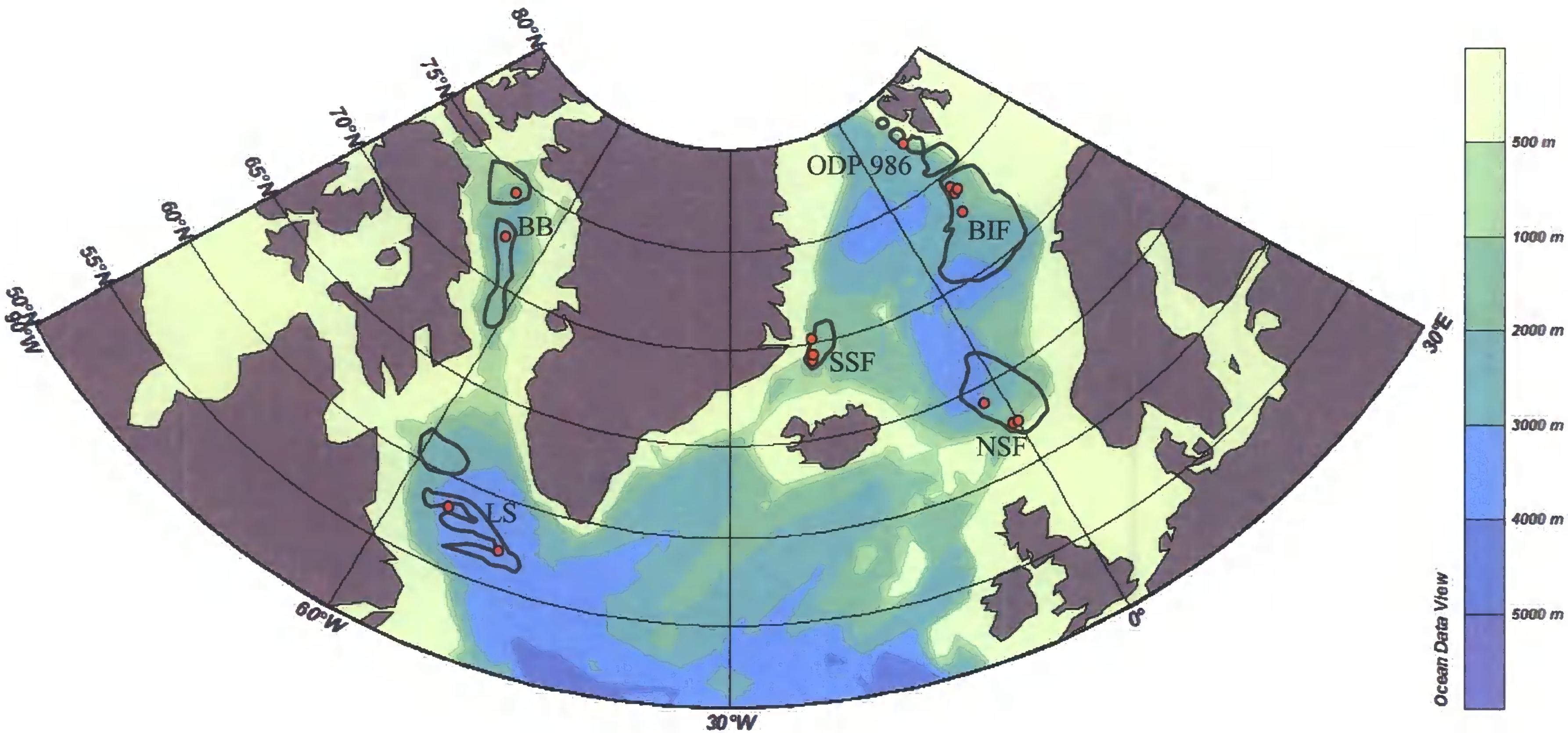


Figure 3.2 a) Core descriptions and sample locations. Bear Island Fan. (O Cofaigh *et al.*, 2002). Core locations are provided in Figure 3.1 and Table 3.1.

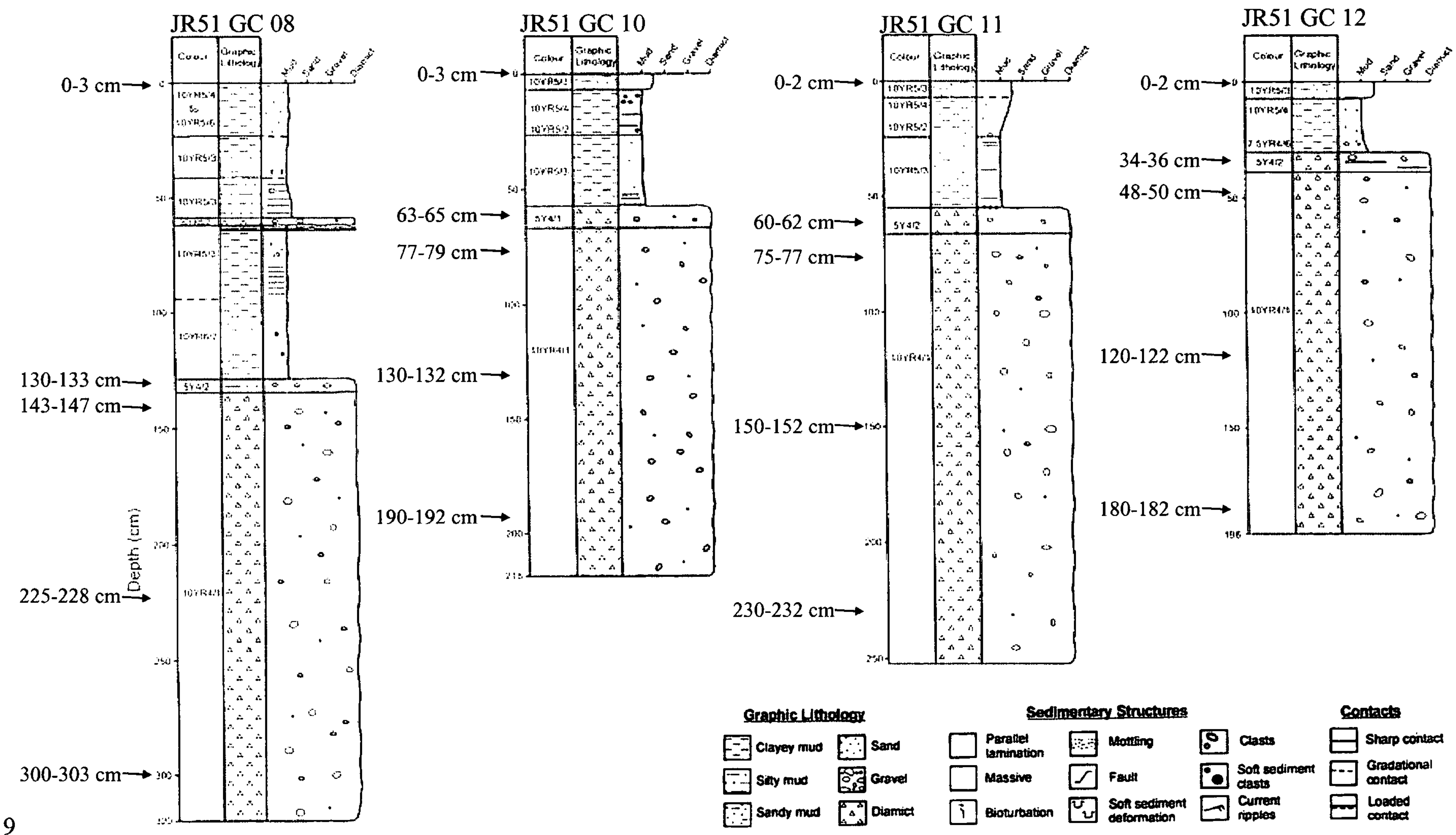


Figure 3.2 b) Core descriptions and sample locations. Scoresby Sund Fan (O Cofaigh *et al.*, 2002). Core locations are provided in Figure 3.1 and Table 3.1.

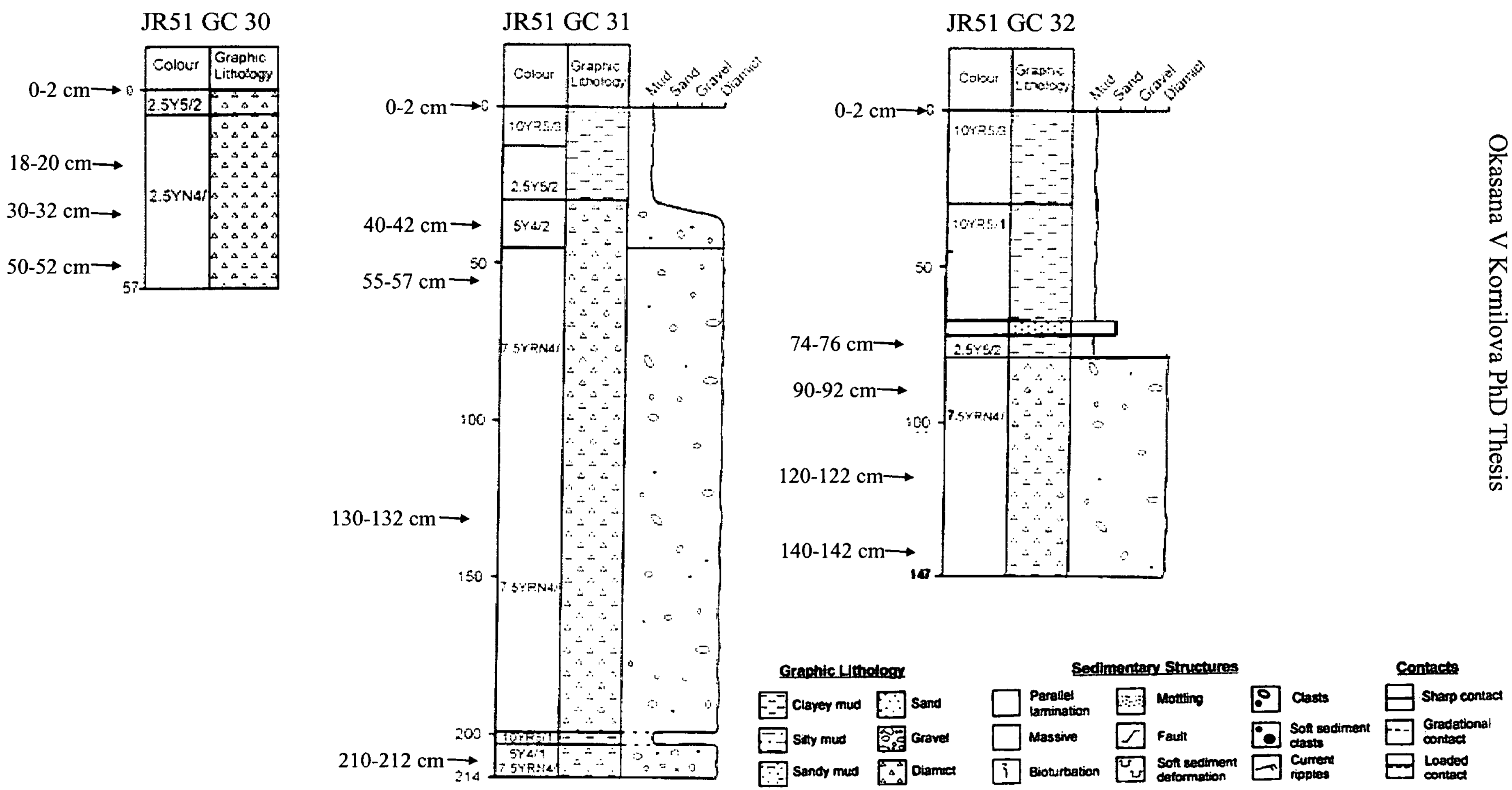


Figure 3.3 a) Bear Island Fan. Absorbance spectra of representative extracts of hemipelagic and debris flows sediments. Fr. – HPLC fraction (See Section 2.2.2)

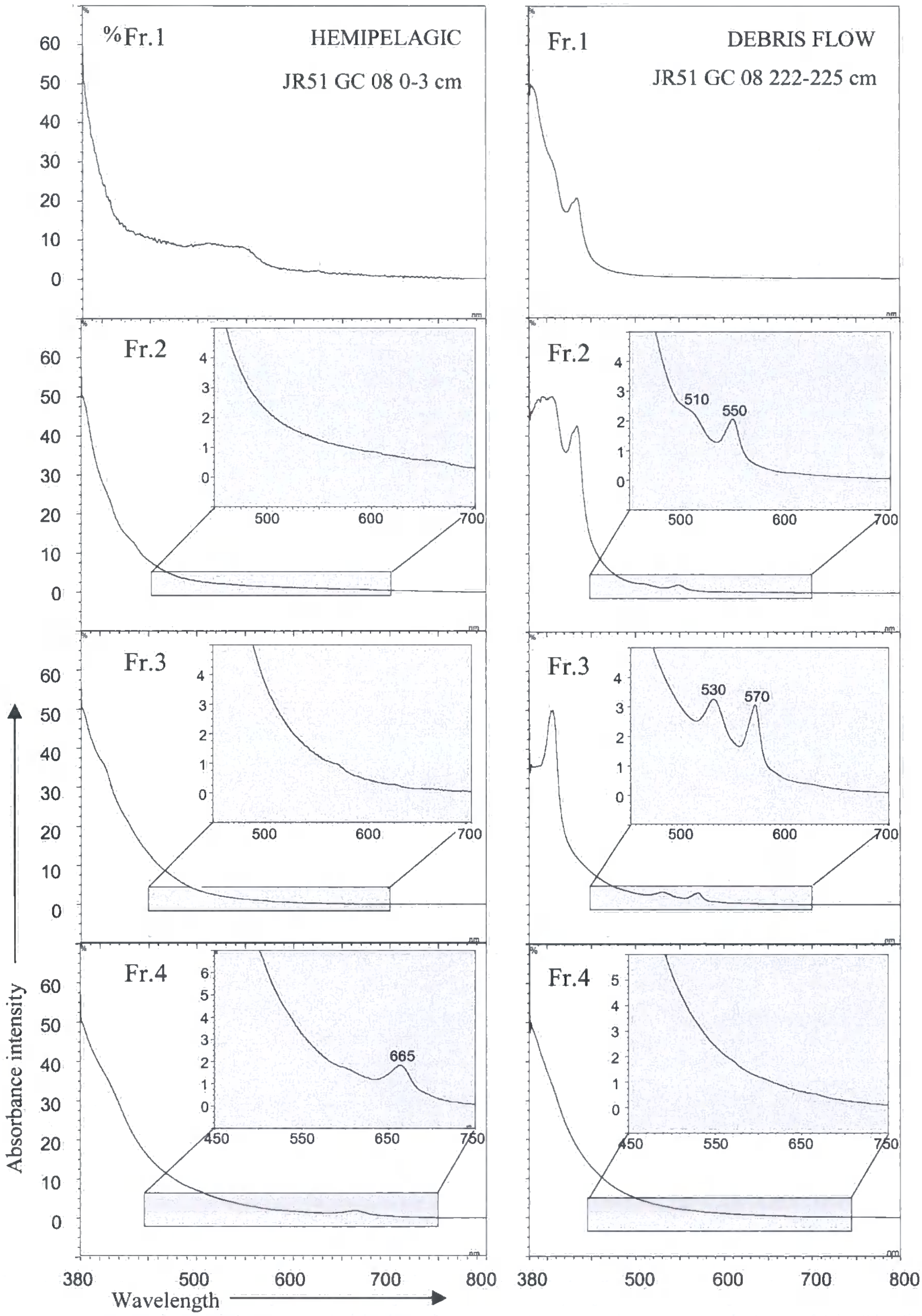


Figure 3.3 b) Scoresby Sund Fan. Absorbance spectra of representative extracts of hemipelagic and debris flows sediments. Fr. – HPLC fraction (See Section 2.2.2)

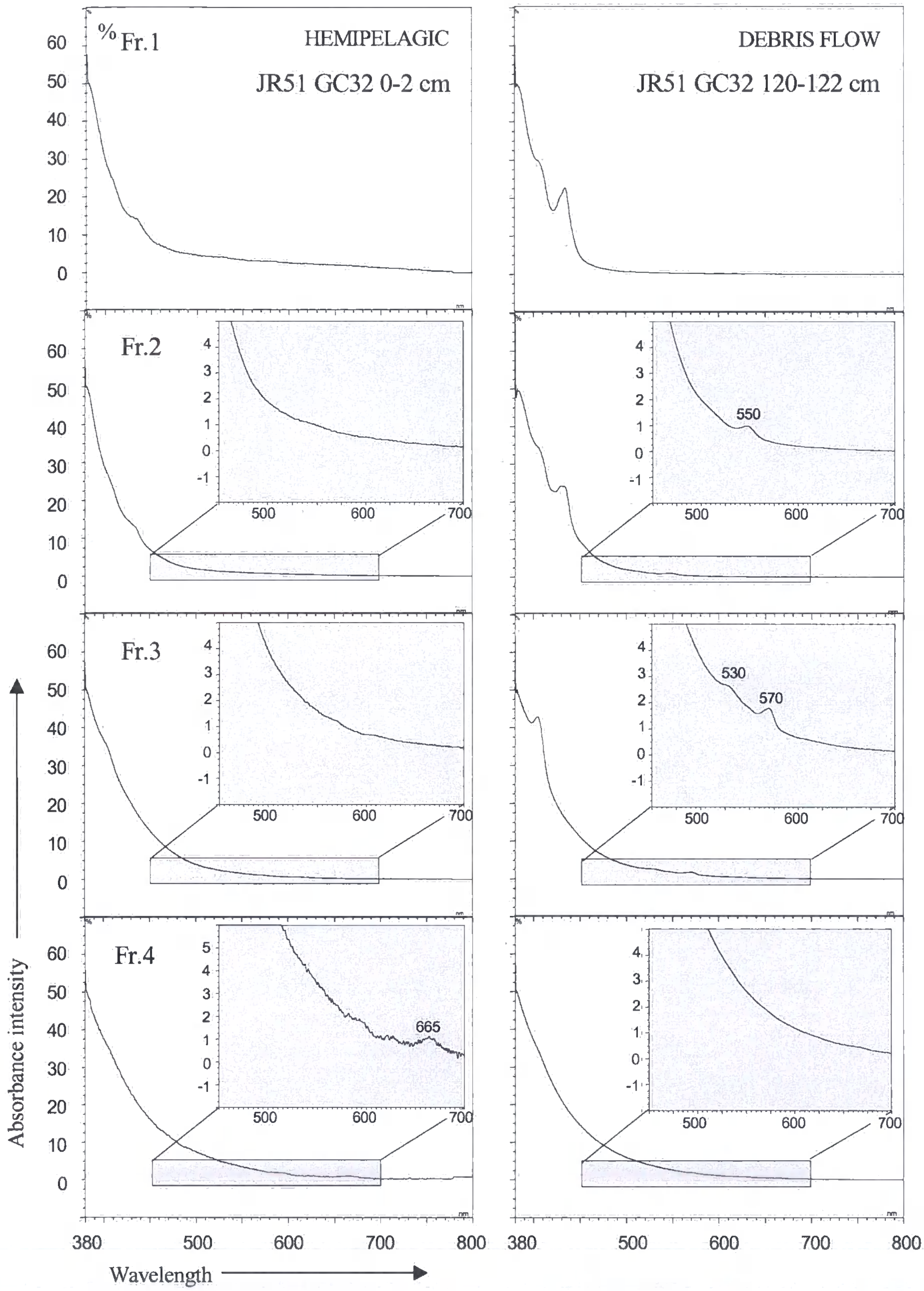


Figure 3.3 c) North Sea Fan. Absorbance spectra of representative extracts of glacimarine and debris flows sediments. Fr. – HPLC fraction (See Section 2.2.2)

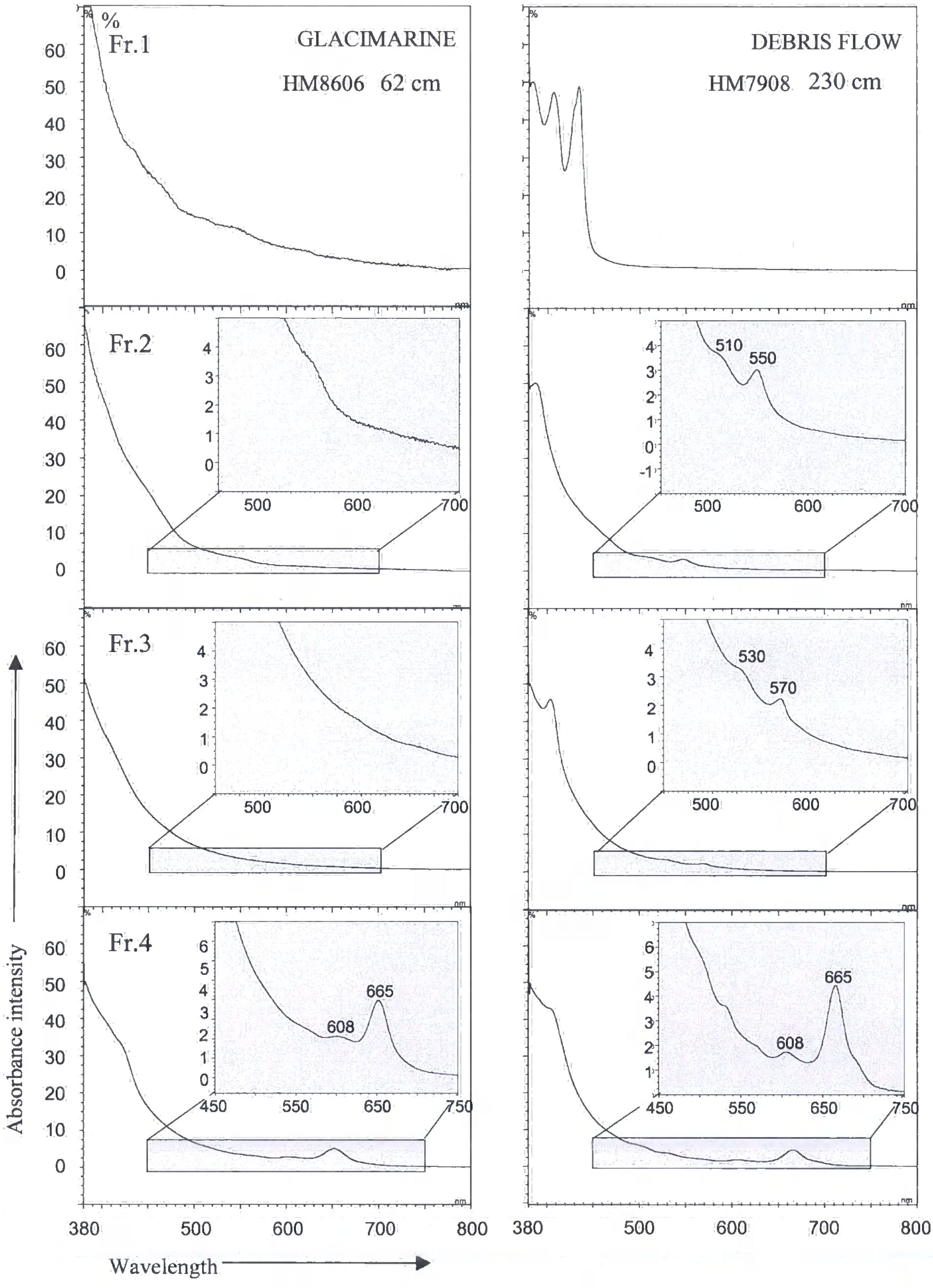


Figure 3.3 d) Svalbard. Absorbance spectra of representative extracts of debris flows sediments. Fr. – HPLC fraction (See Section 2.2.2)

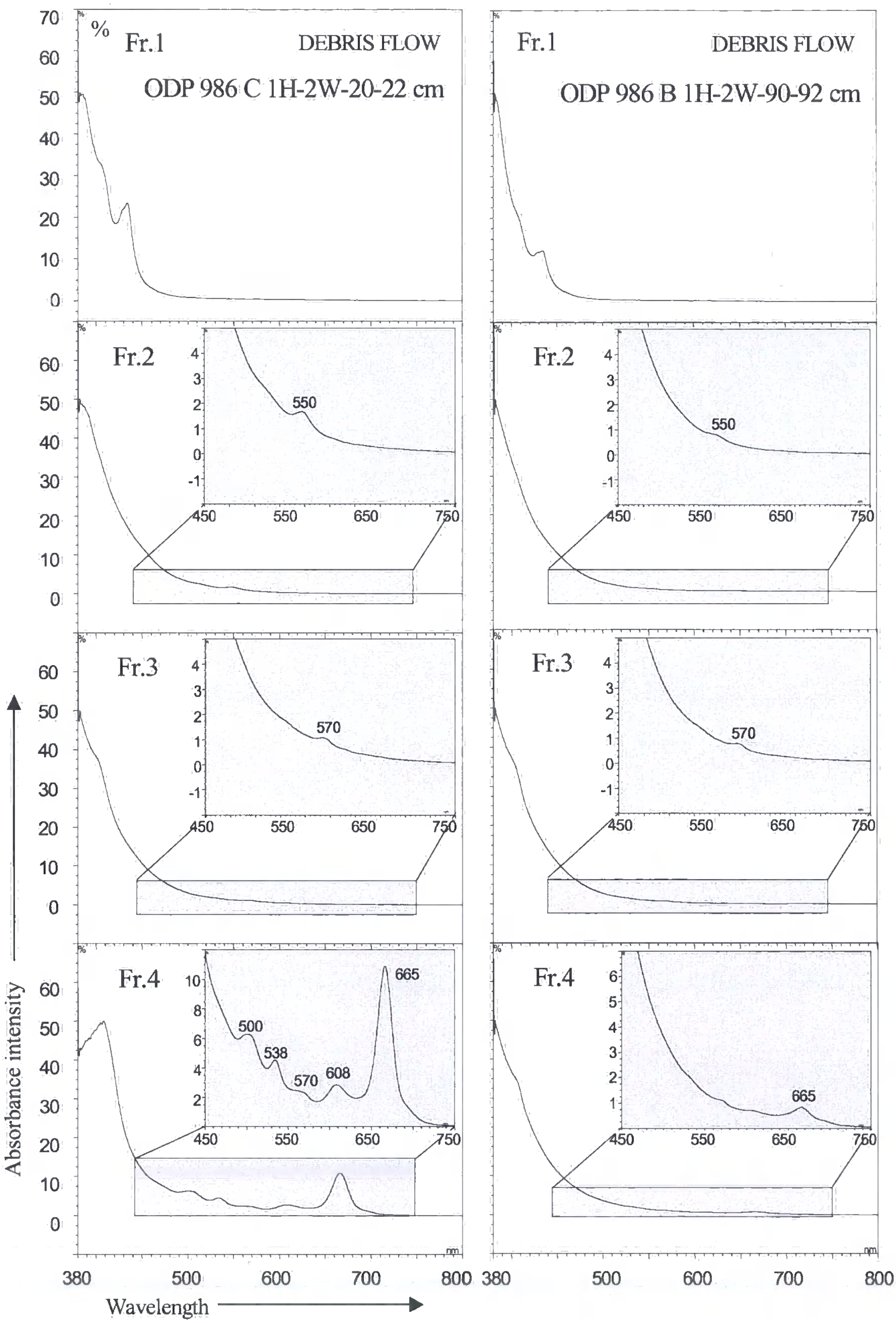


Figure 3.3 e) Baffin Bay. Absorbance spectra of representative extracts of debris flows sediments from the two cores. Fr. – HPLC fraction (See Section 2.2.2)

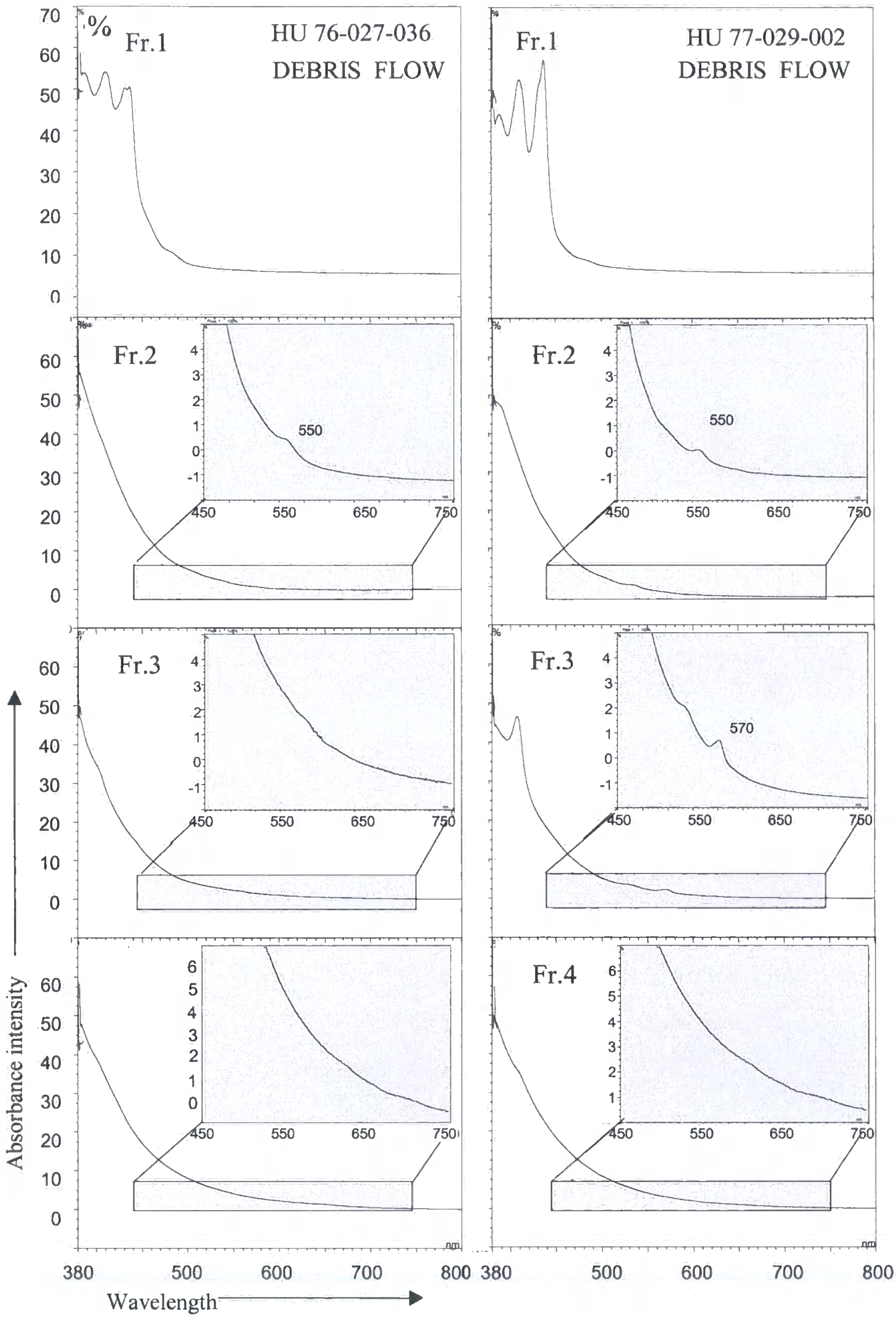


Figure 3.3 f) Labrador Sea. Absorbance spectra of representative extracts of debris flows and HI (IRD+Hemipelagic) Fr. – HPLC fraction (See Section 2.2.2)

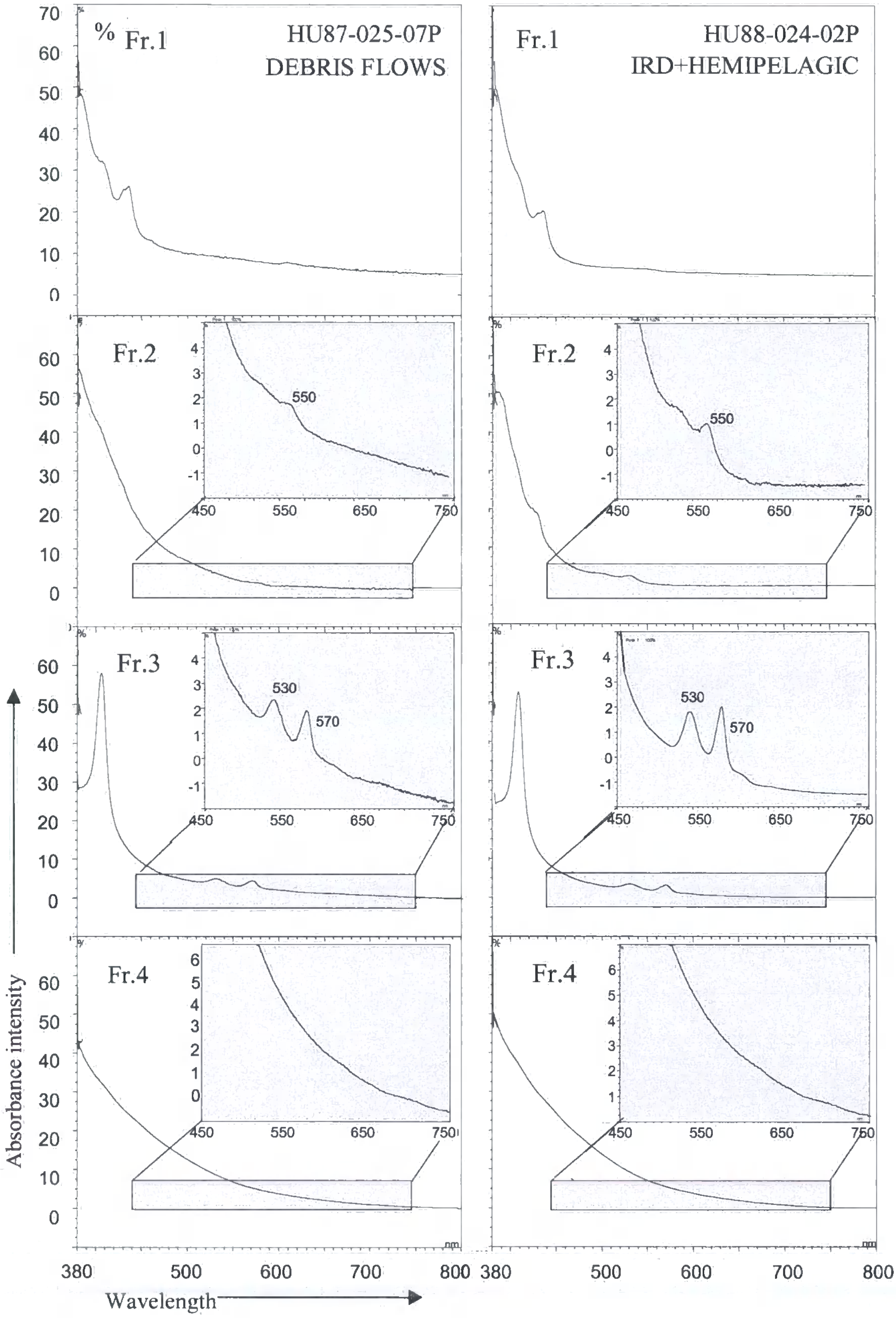


Figure 3.4 a) Bear Island Fan. Gas chromatogram of the saturated fraction of representative extracts of hemipelagic (A) and debris flows (B) sediments. UCM – unresolved complex mixture.

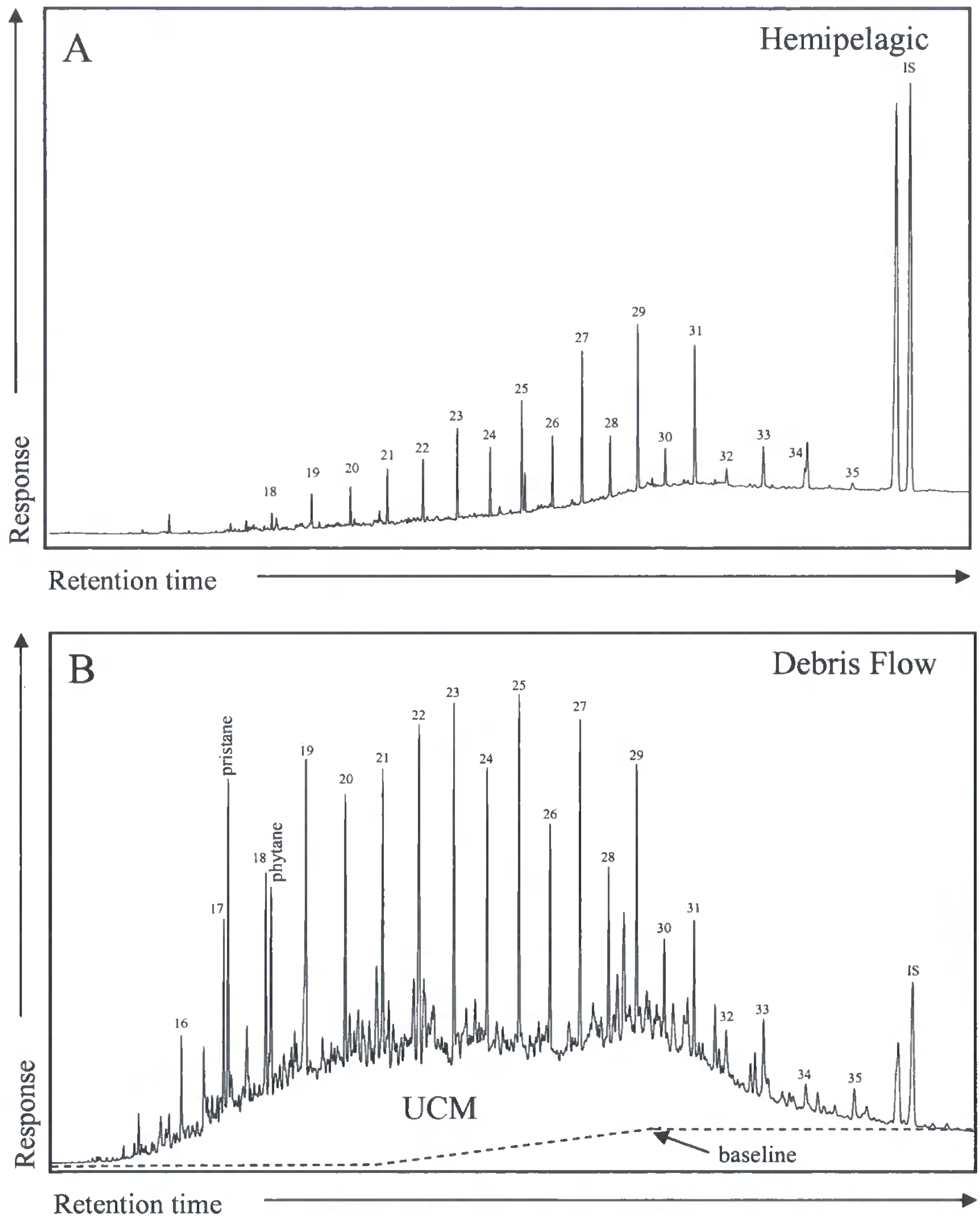


Figure 3.4 b) Scoresby Sund Fan. Gas chromatogram of the saturated fraction of representative extracts of hemipelagic (A), debris flow (B) and glacial till (C) sediments. UCM – unresolved complex mixture.

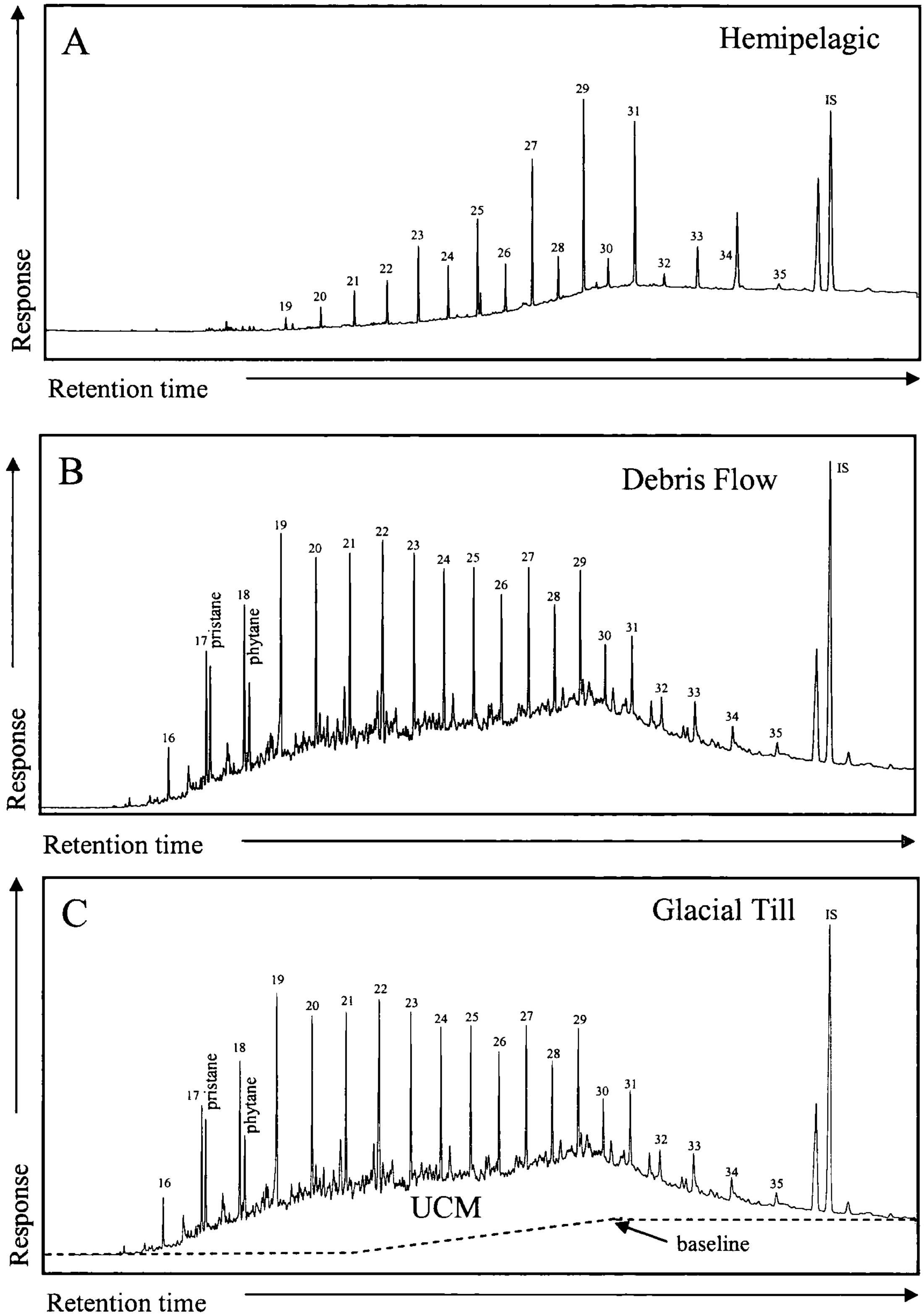


Figure 3.4 c) North Sea Fan. Gas chromatogram of the saturated fraction of representative extracts of glacimarine (A) and debris flows sediments (B).

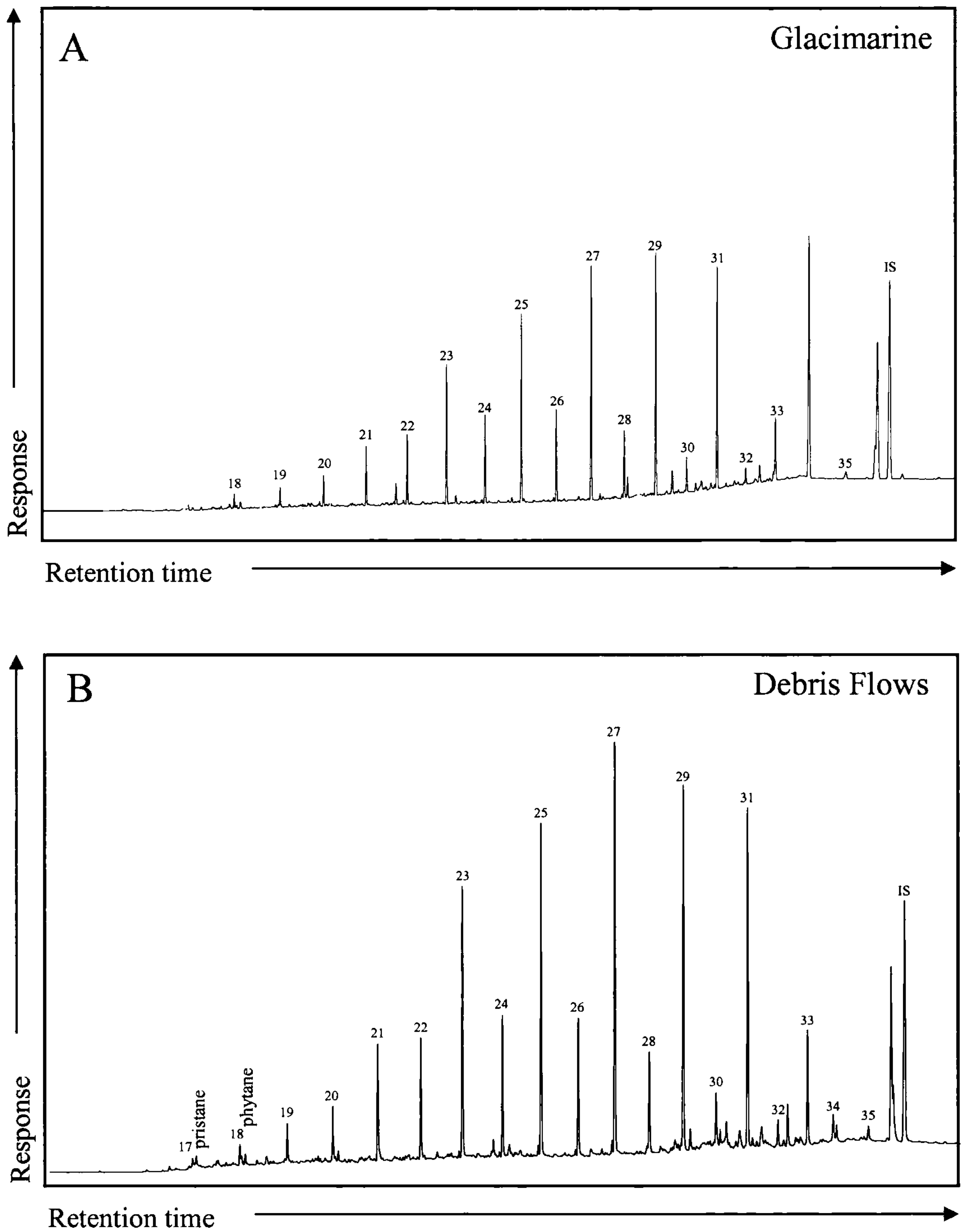


Figure 3.4 d) Svalbard. A) Gas chromatogram of the saturated fraction of representative extracts of debris flows sediments. B) Sample C1H2-90 cm. UCM- unresolved complex mixture.

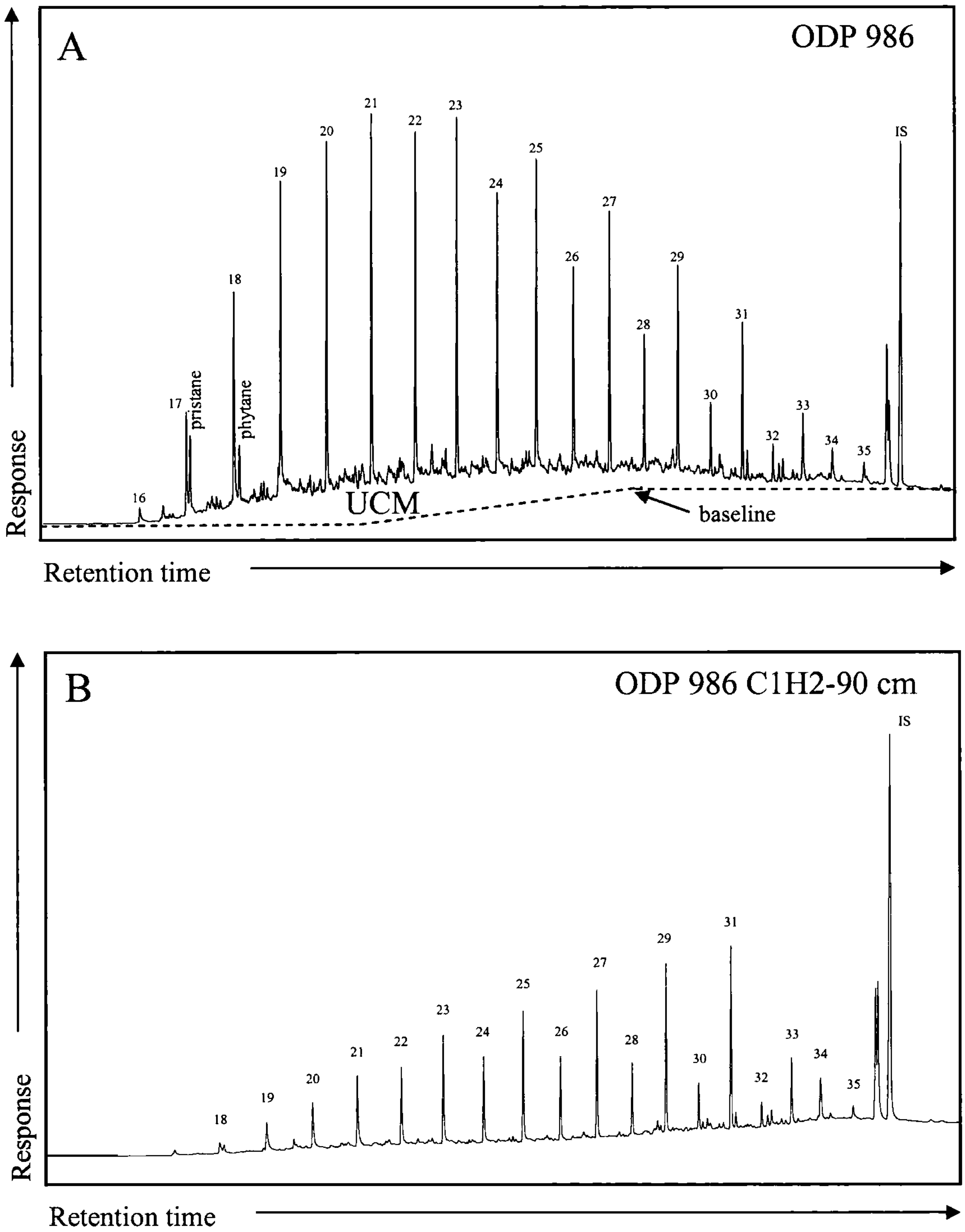


Figure 3.4 e) Baffin Bay. Gas chromatogram of the saturated fraction of representative extracts of debris flows sediments from two different cores.

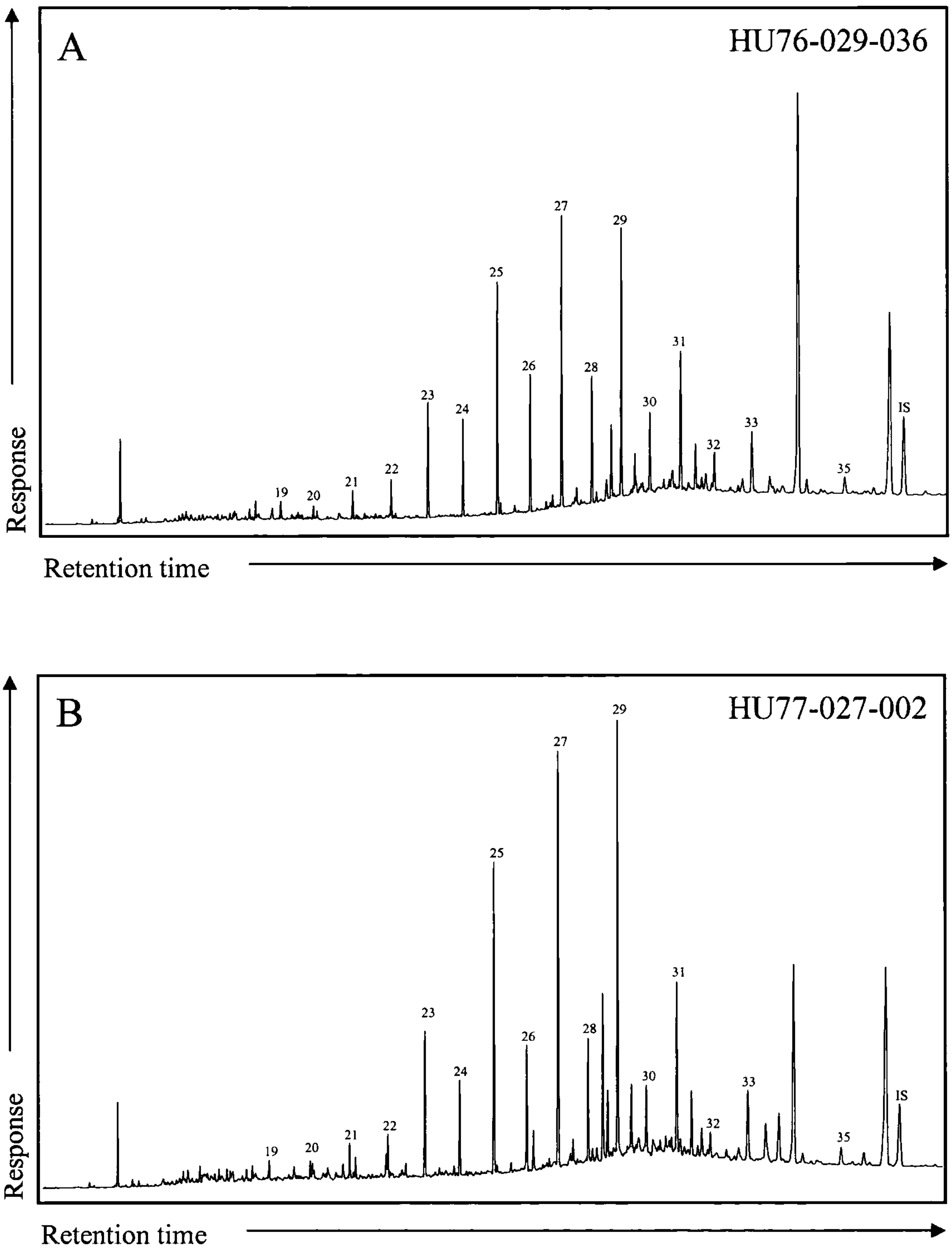


Figure 3.4 f) Labrador Sea. Gas chromatogram of the saturated fraction of representatir457yhbnme extracts of hemipelagic (A), debris flows (B) and ice rafted-hemipelagic sediments (C).

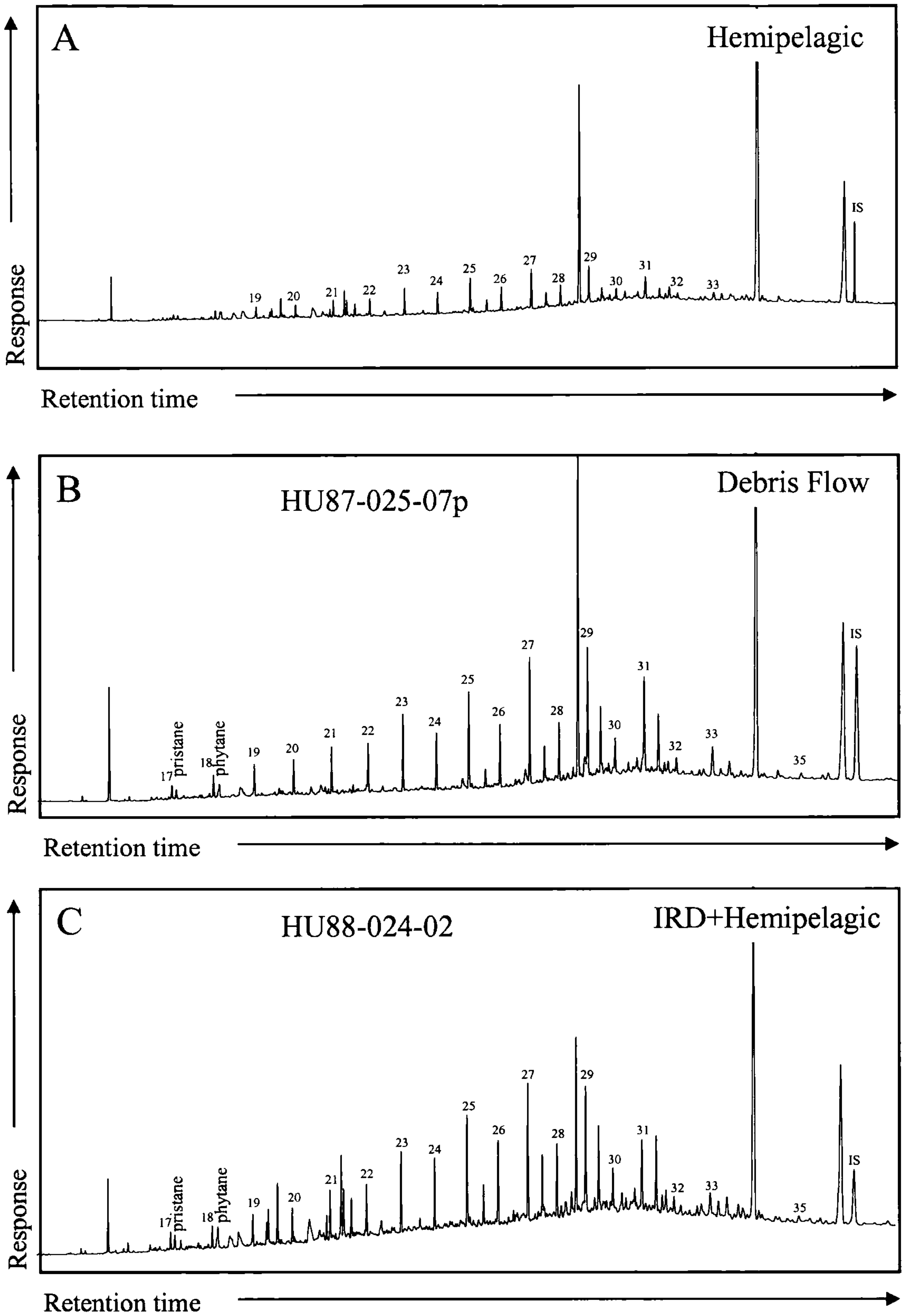


Figure 3.5. Core locations and estimates of sea surface temperature(SST) for the last glacial maximum derived from U^{K}_{37}' (blue) (Rosell-Melé & Comes, 1999). Red - Core locations and estimates of sea surface temperature of Debris Flows containing alkenones. Yellow – Core locations of Debris Flows with no alkenones. SSF – Scoresby Sund Fan, BIF – Bear Island Fan, NSF – North Sea Fan.

SST (U^{K}_{37}')

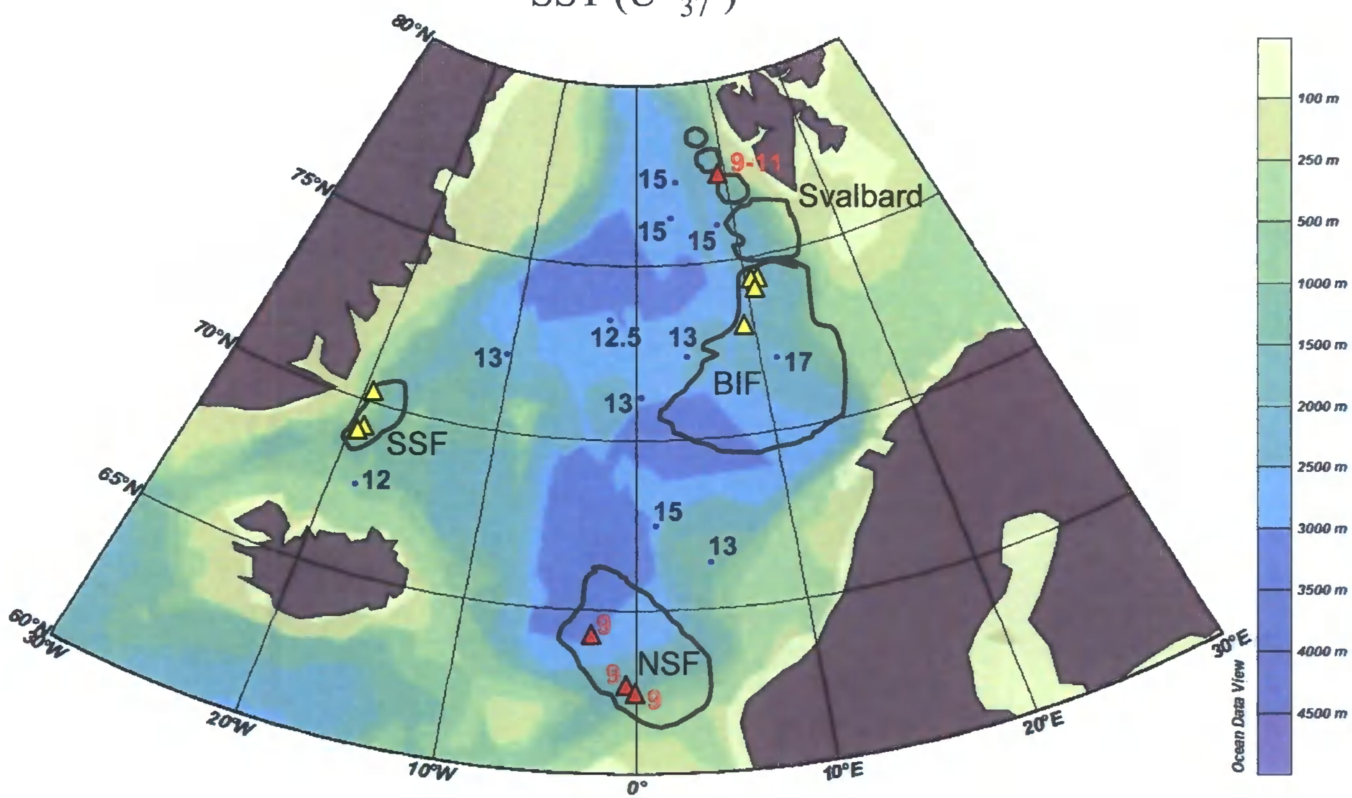


Figure 3.6. Core HM 8306 from the North Sea Fan. HP – hemipelagic, GM – glacimarine, DF – debris flow. TOC – total organic carbon (King *et al.*, 1998), SST – sea surface temperature estimate using U^{K}_{37}', ΣC_{37} – concentration of total triunsaturated and diunsaturated alkenones, % $C_{37:4}$ – relative abundance of the tetraunsaturated alkenone. Error bars are smaller than the symbols.

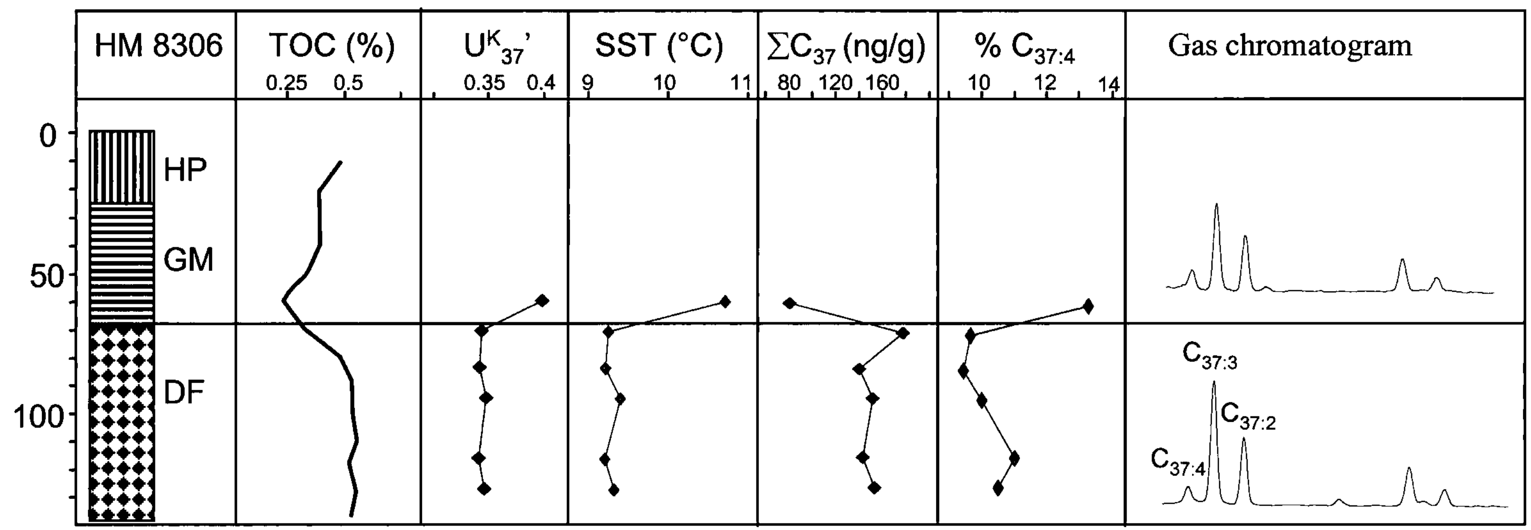


Figure 3.7. Blue - Core locations and relative abundance of C37:4 alkenone for the last glacial maximum derived from U^{K}_{37}' (Rosell-Melé & Comes, 1999). Red - Core locations and relative abundance of C37:4 alkenone of Debris Flows containing alkenones. Yellow – Core locations of Debris Flows with no alkenones. SSF – Scoresby Sund Fan, BIF – Bear Island Fan, NSF – North Sea Fan.

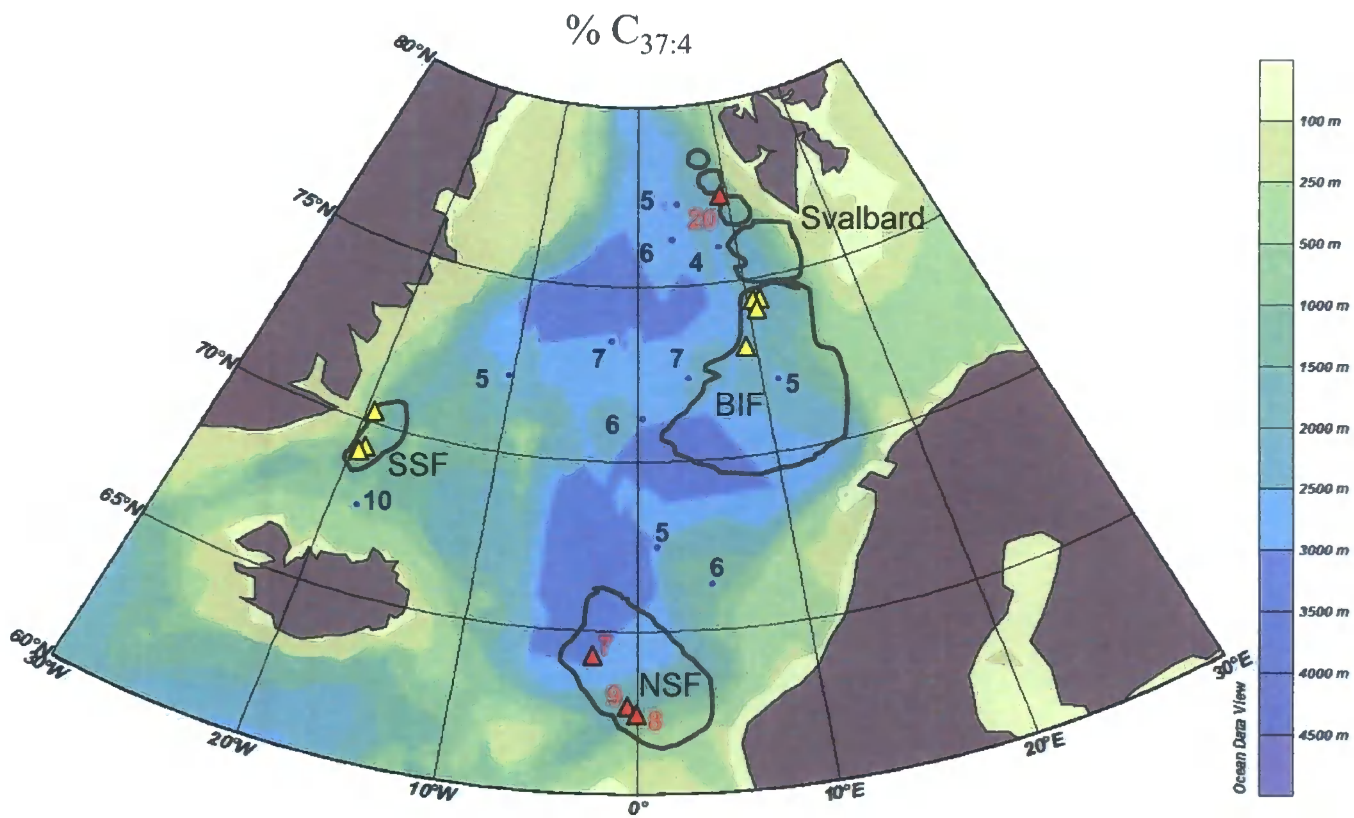


Figure 3.8 A simplified map showing outcrops of sedimentary strata along the North Atlantic margins. (Choubert *et al.*, 1987).

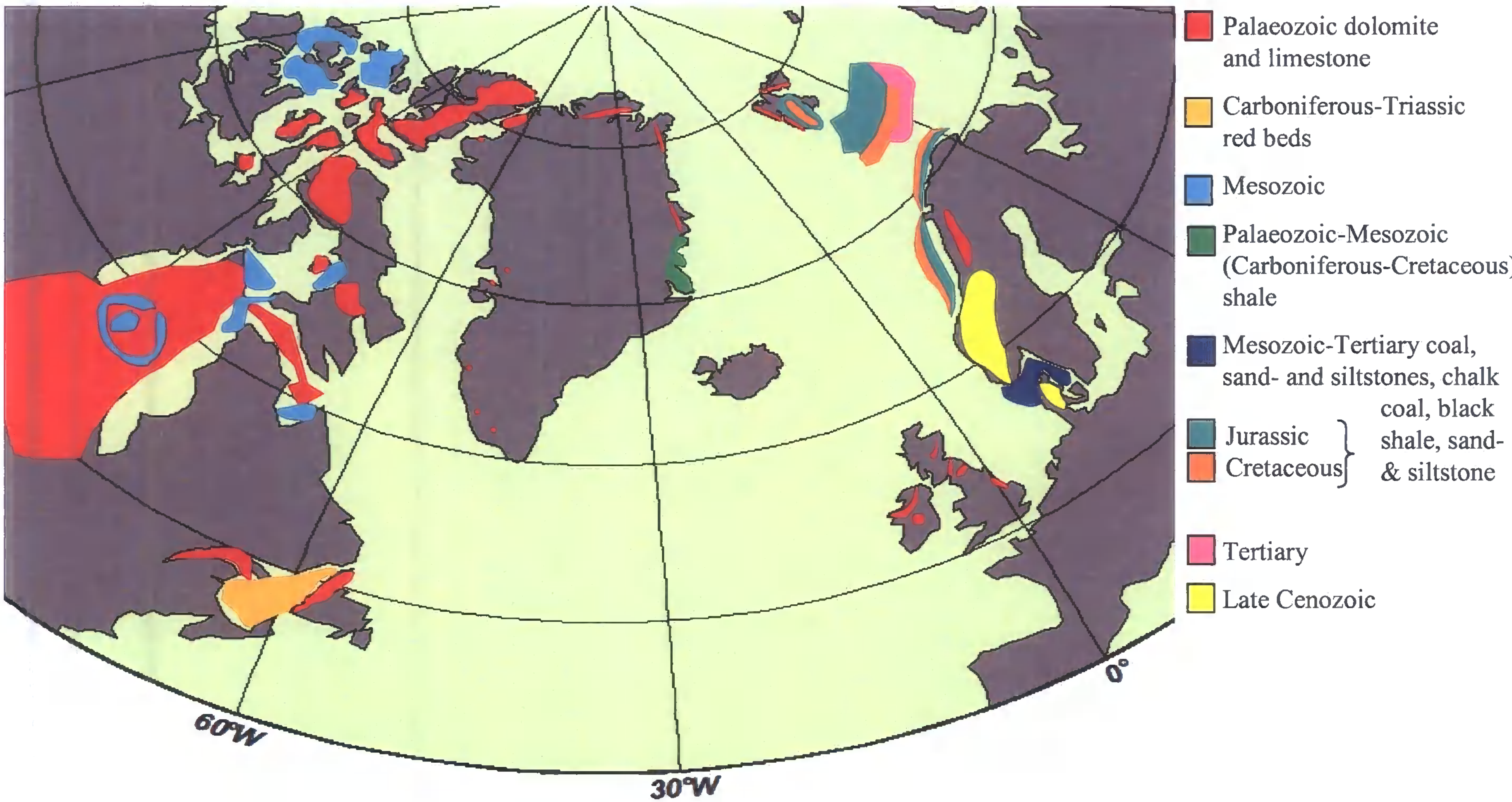


Figure 3.9 a) Principal component 1 plotted against Principal component 2. BIF – Bear Island Fan, SSF – Scoresby Sund Fan, NSF – North Sea Fan, SVALB –ODP site 986, BB – Baffin Bay, LS – Labrador Sea.

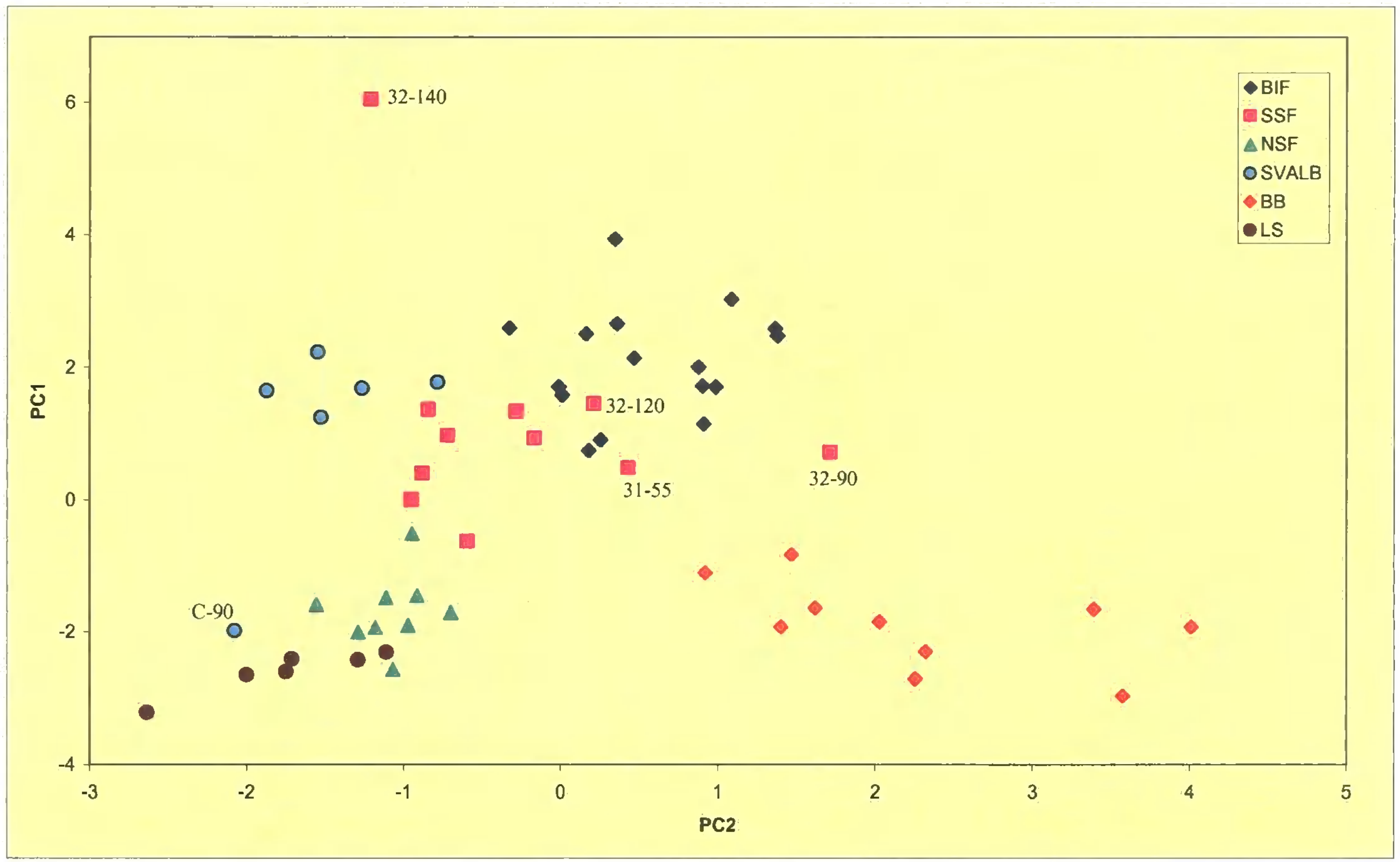


Figure 3.9 b) Principal component 2 plotted against Principal component 3. BIF – Bear Island Fan, SSF – Scoresby Sund Fan, NSF – North Sea Fan, SVALB –ODP site 986, BB – Baffin Bay, LS – Labrador Sea.

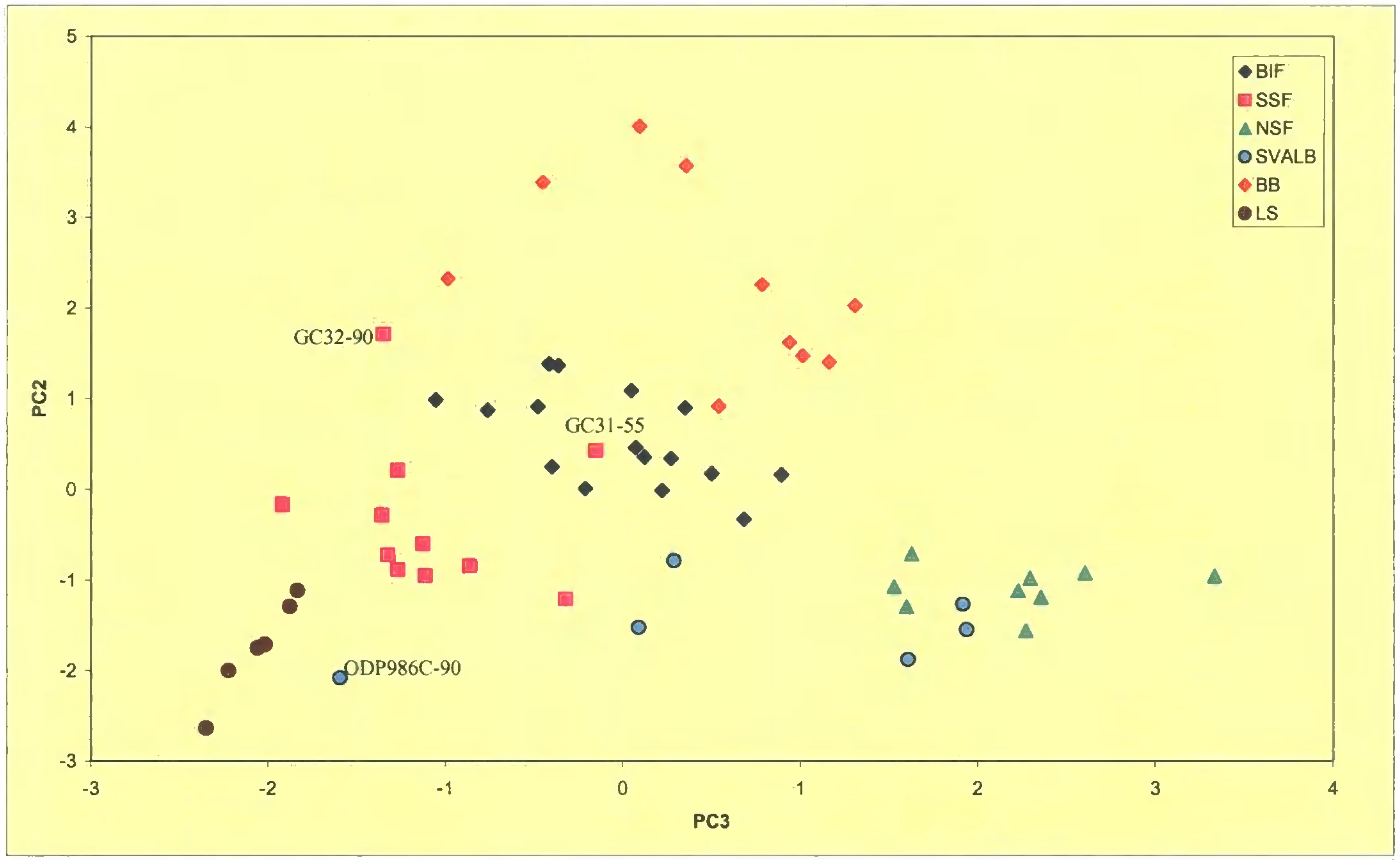


Figure 3.9 c) Principal component 3 plotted against Principal component 1. BIF – Bear Island Fan, SSF – Scoresby Sund Fan, NSF – North Sea Fan, SVALB –ODP site 986, BB – Baffin Bay, LS – Labrador Sea.

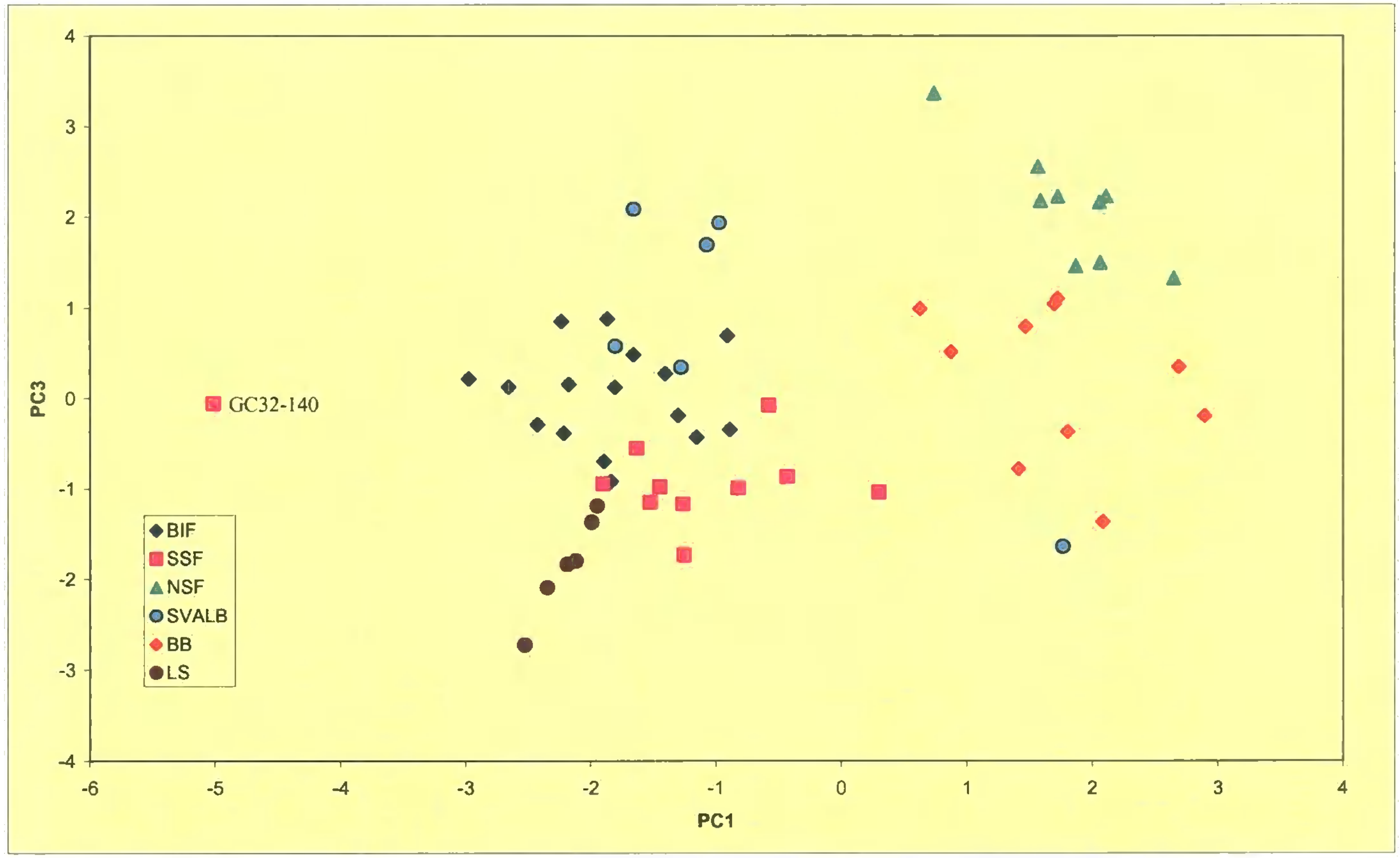


Figure 3.10 Chain-length distributions of n-alkanes in representative samples of potential sources of IRD with average values for Carbon preference index (CPI_{24-31}), average chain length (ACL_{25-33}) and relative abundance of long-chain n-alkanes.

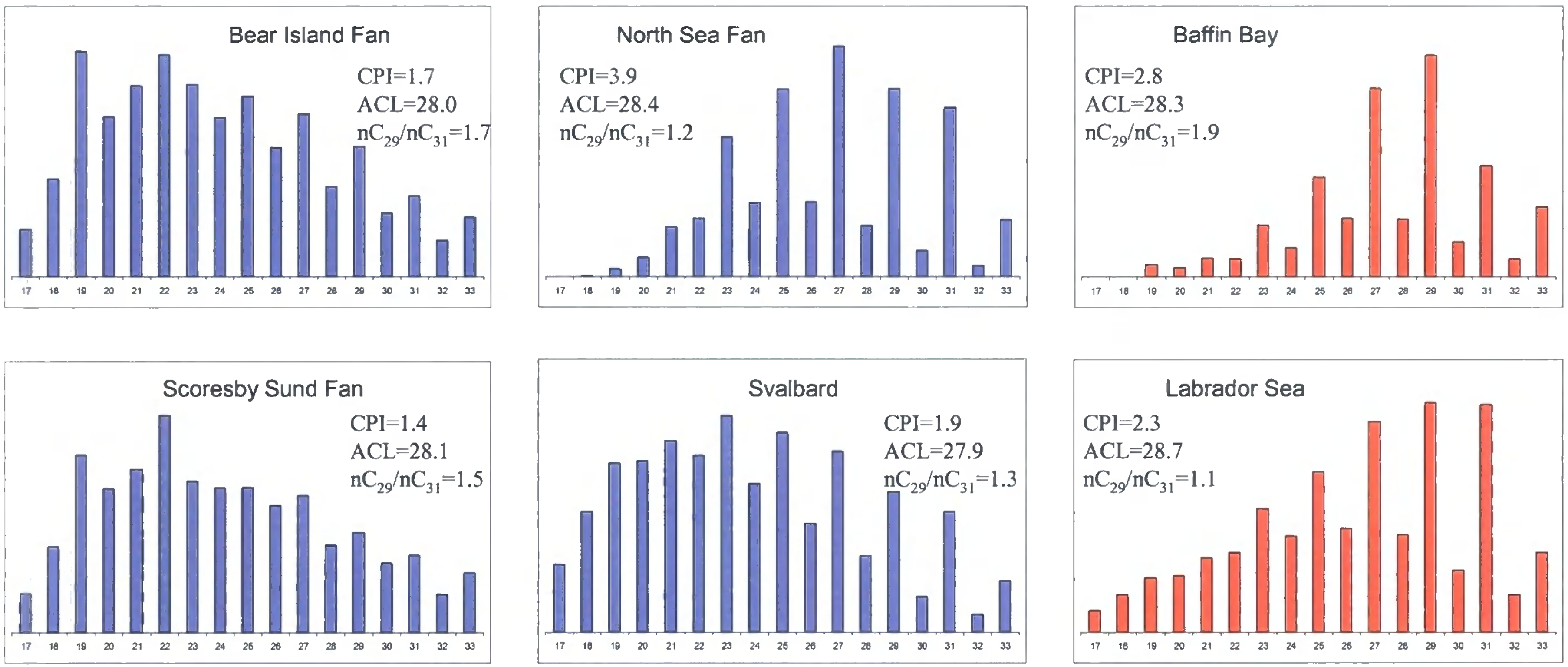


Figure 3.11 a). Pristane to phytane ratio plotted against pristane to nC_{17} ratio. BIF – Bear Island Fan, SSF – Scoresby Sund Fan, NSF – North Sea Fan, SVALB –ODP site 986.

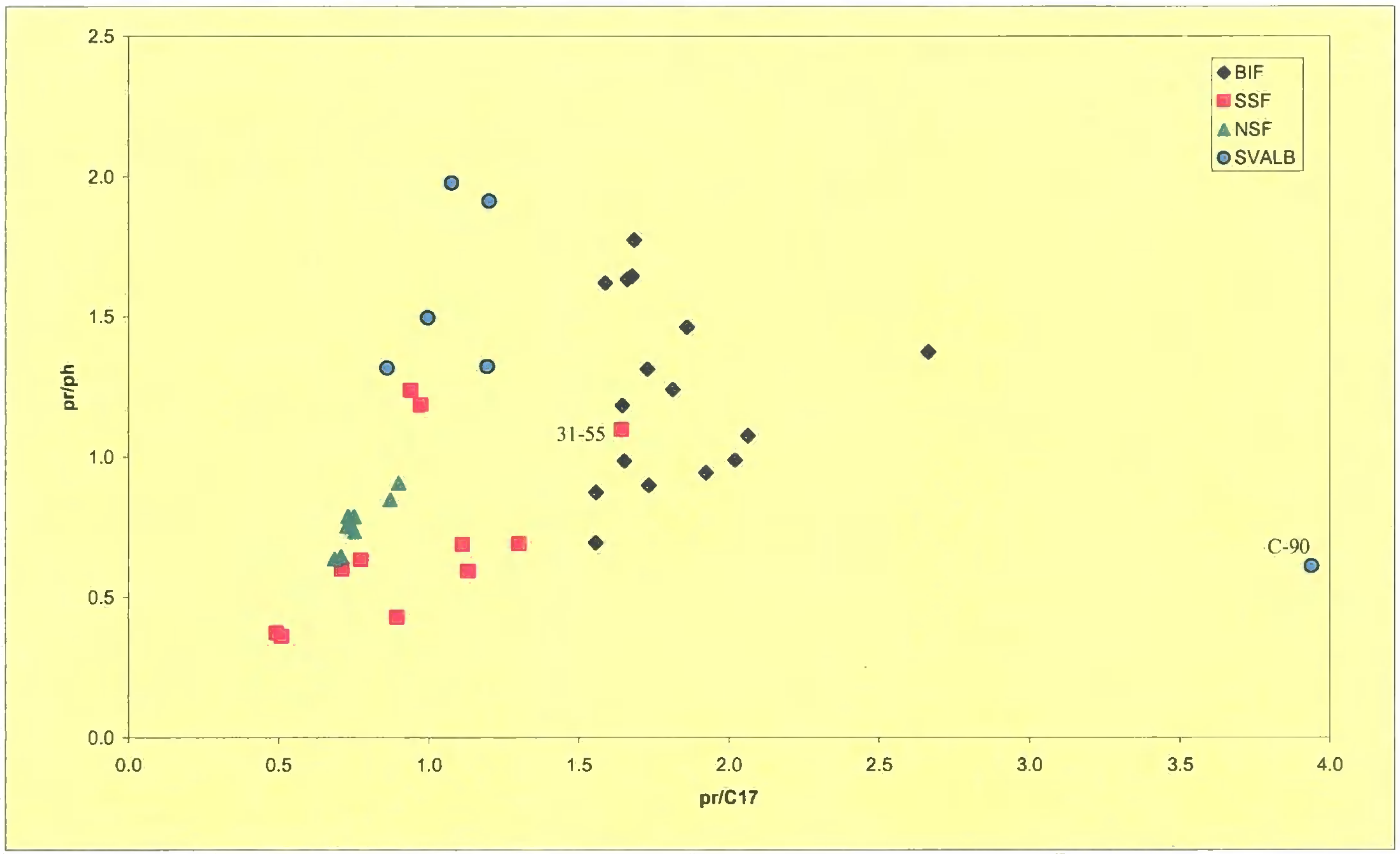


Figure 3.11 b). Pristane to nC_{17} ratio plotted against phytane to nC_{17} ratio. BIF – Bear Island Fan, SSF – Scoresby Sund Fan, NSF – North Sea Fan, SVALB –ODP site 986.

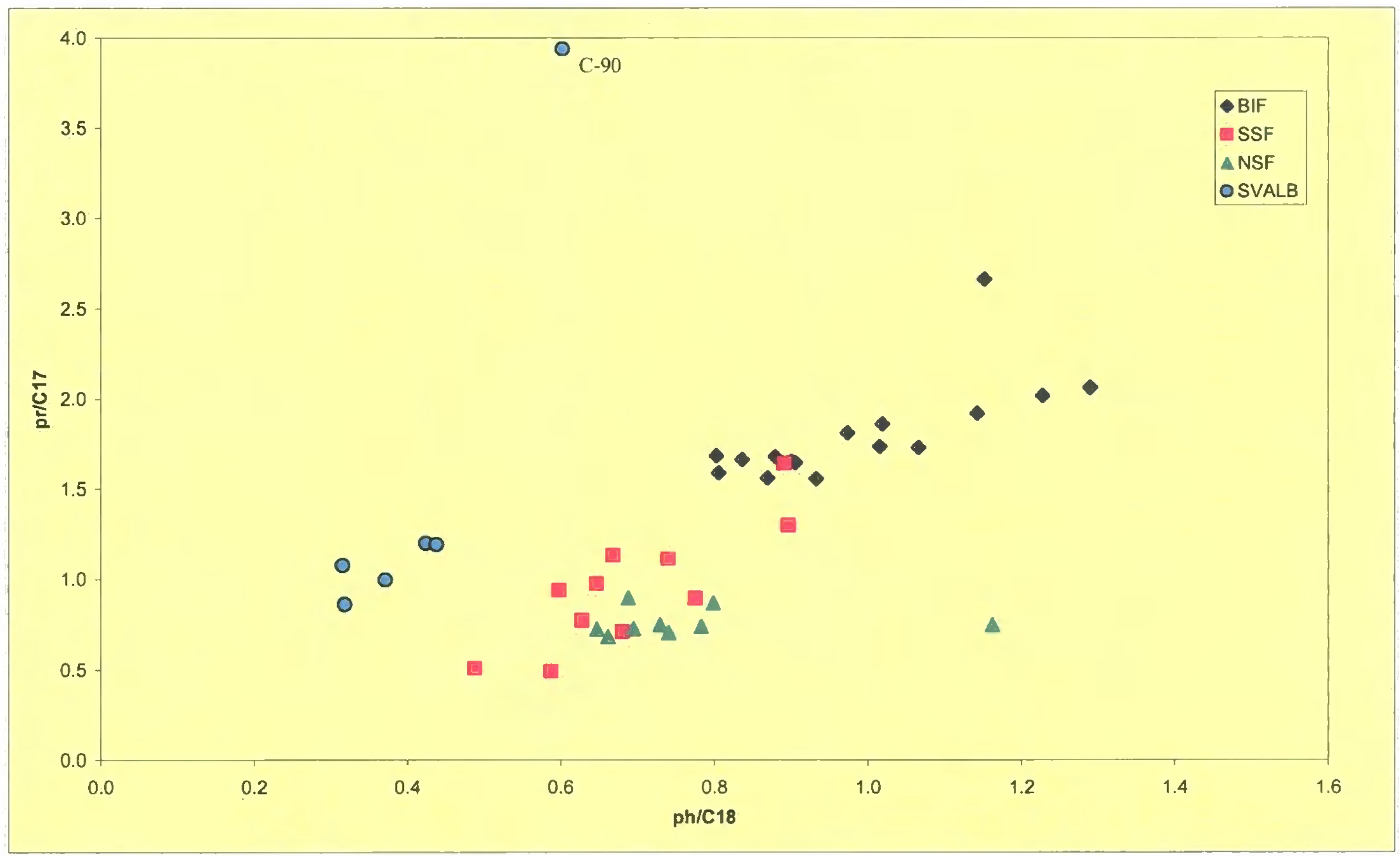


Figure 4.1 Core locations of Heinrich Layers samples. Grey line – rough outline of the IRD belt (Ruddiman, 1977). Arrows – hypothesized pathways of icebergs (after Grousset *et al.*, 2000).

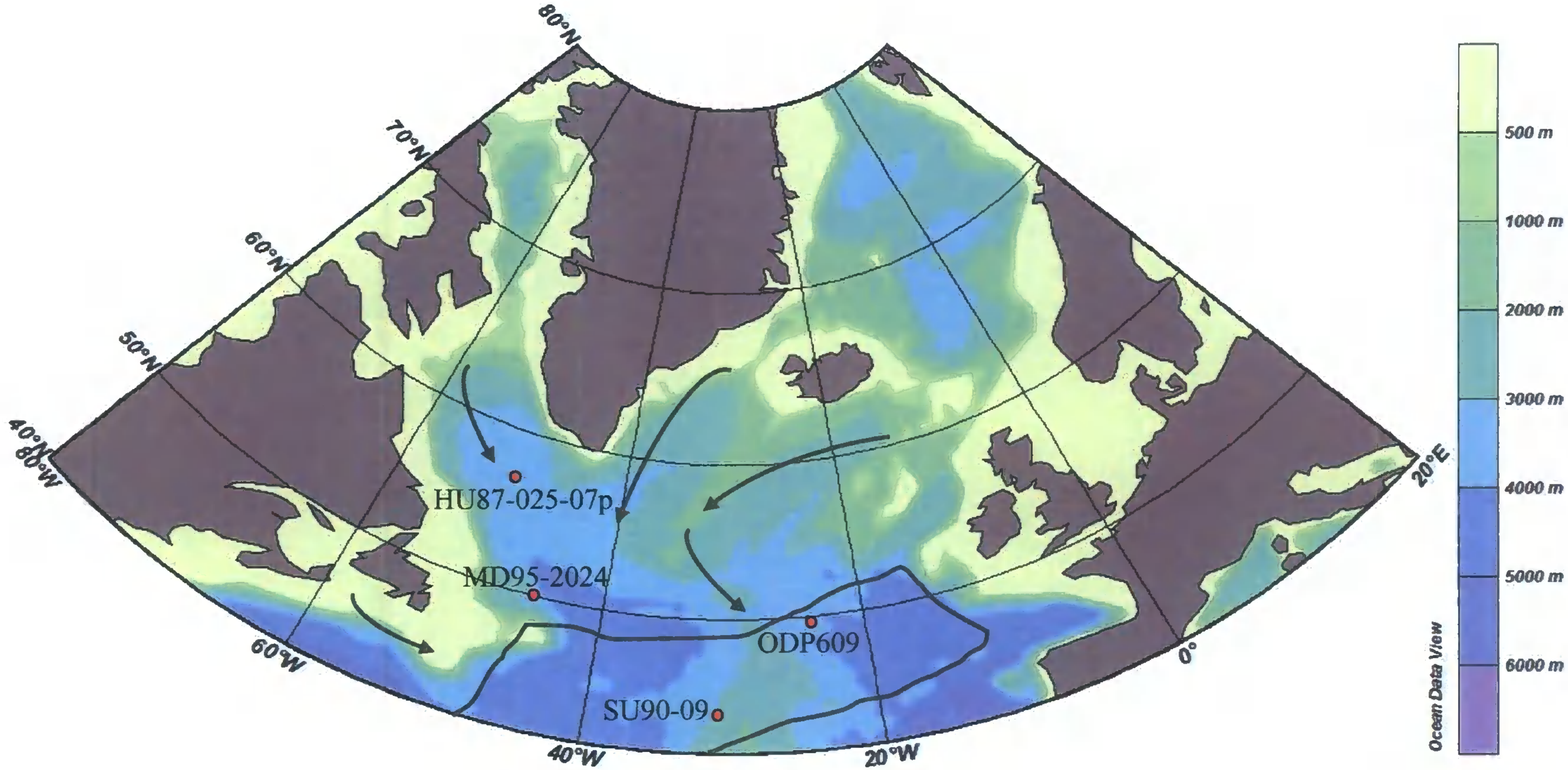


Figure 4.2 Abundance of photosynthetic pigments in Heinrich layers and ambient glacigenic sediments of the core SU90-09. Pr – precursor event (Grousset *et al.*, 2001).

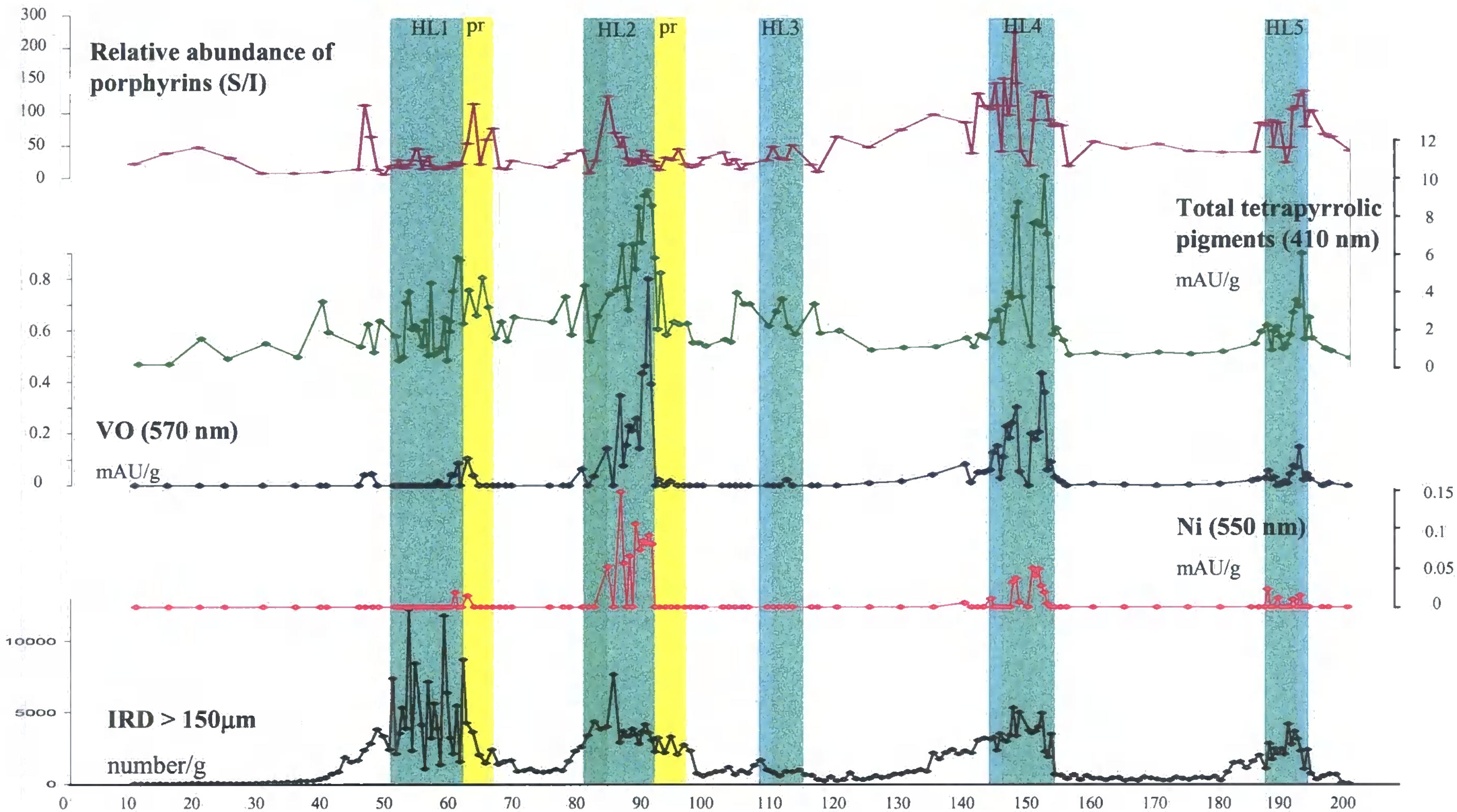


Figure 4.3 Gas chromatograms and chain-length distribution of n–alkanes of the representative samples of the HL and ambient glacial sediments from the core SU90-09. N-alkanes are marked with numbers corresponding to the number of carbon atoms.

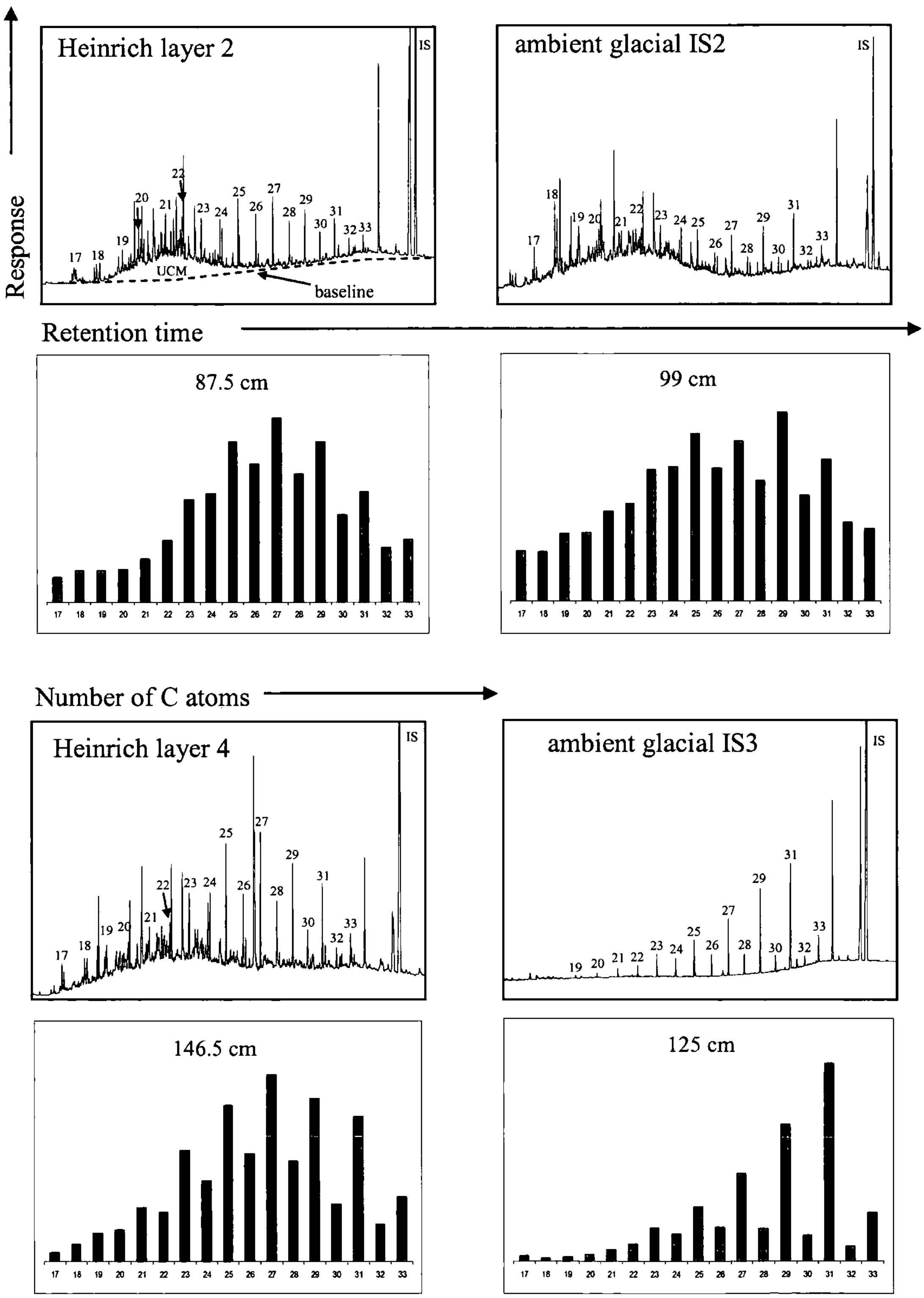


Figure 4.4 Down-core variation of the principal components 1-3 for SU90-09.

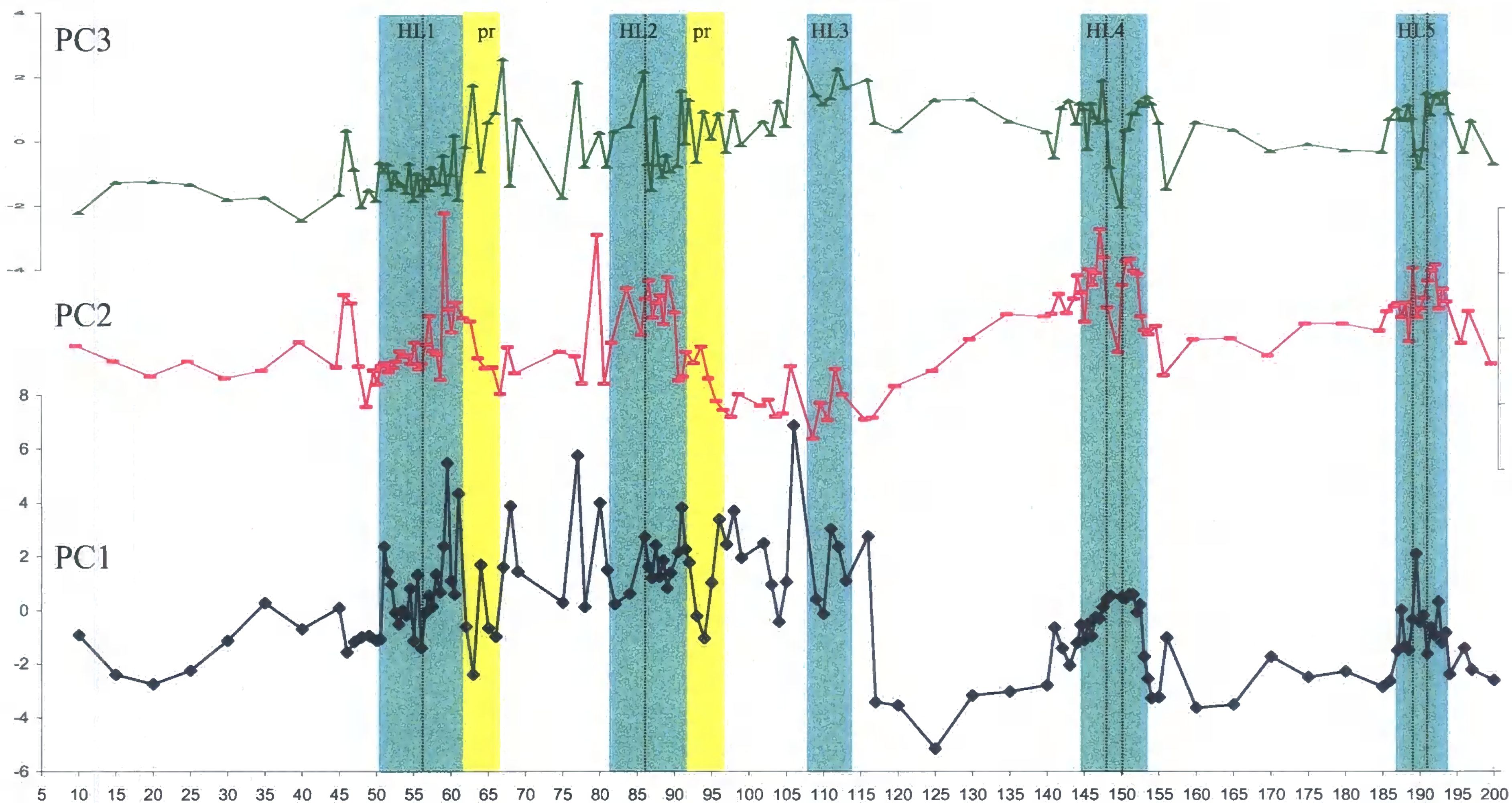
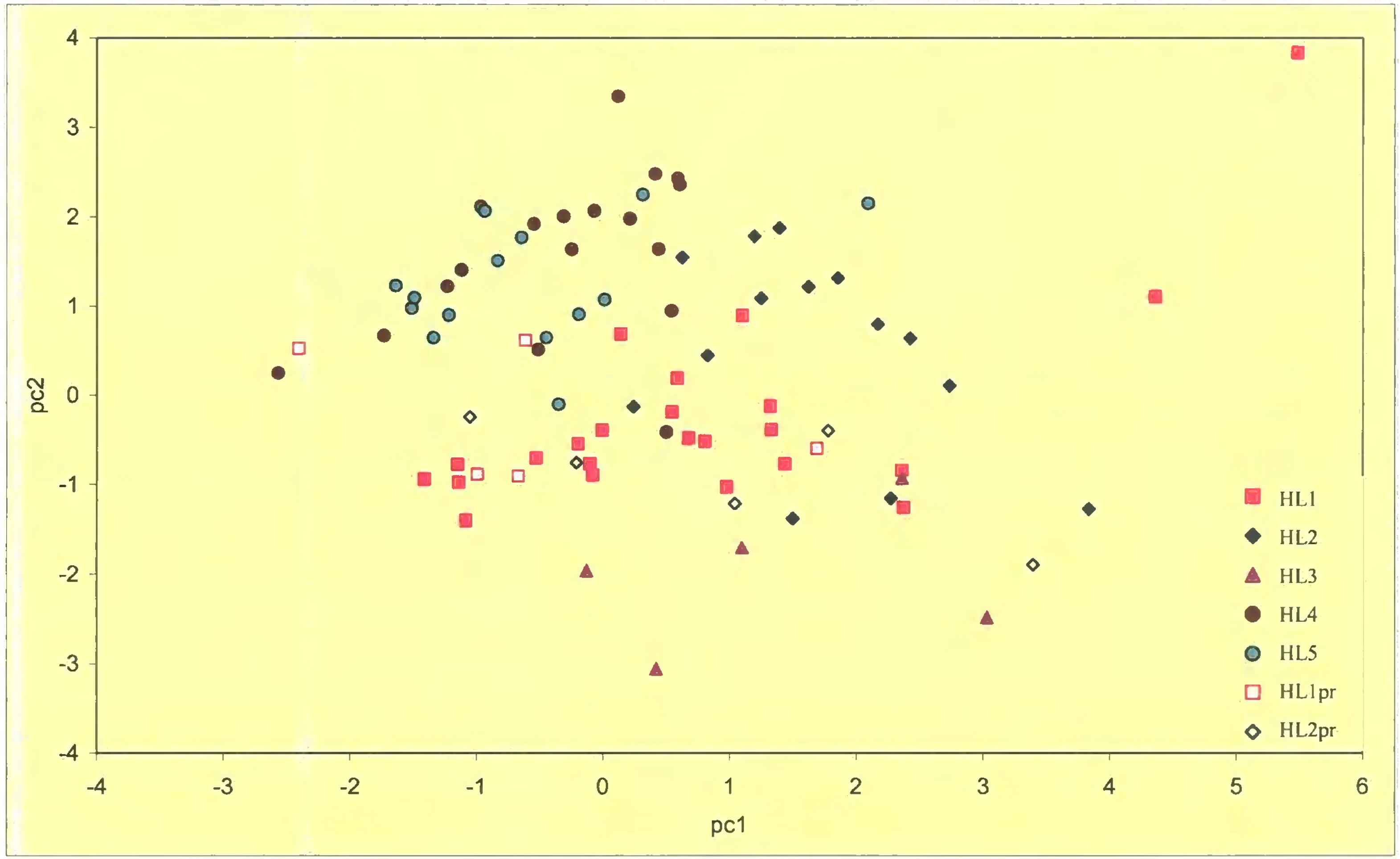


Figure 4.5 a) Heinrich layers from SU90-09. Principal component 1 plotted against principal component 2. pr –precursor.



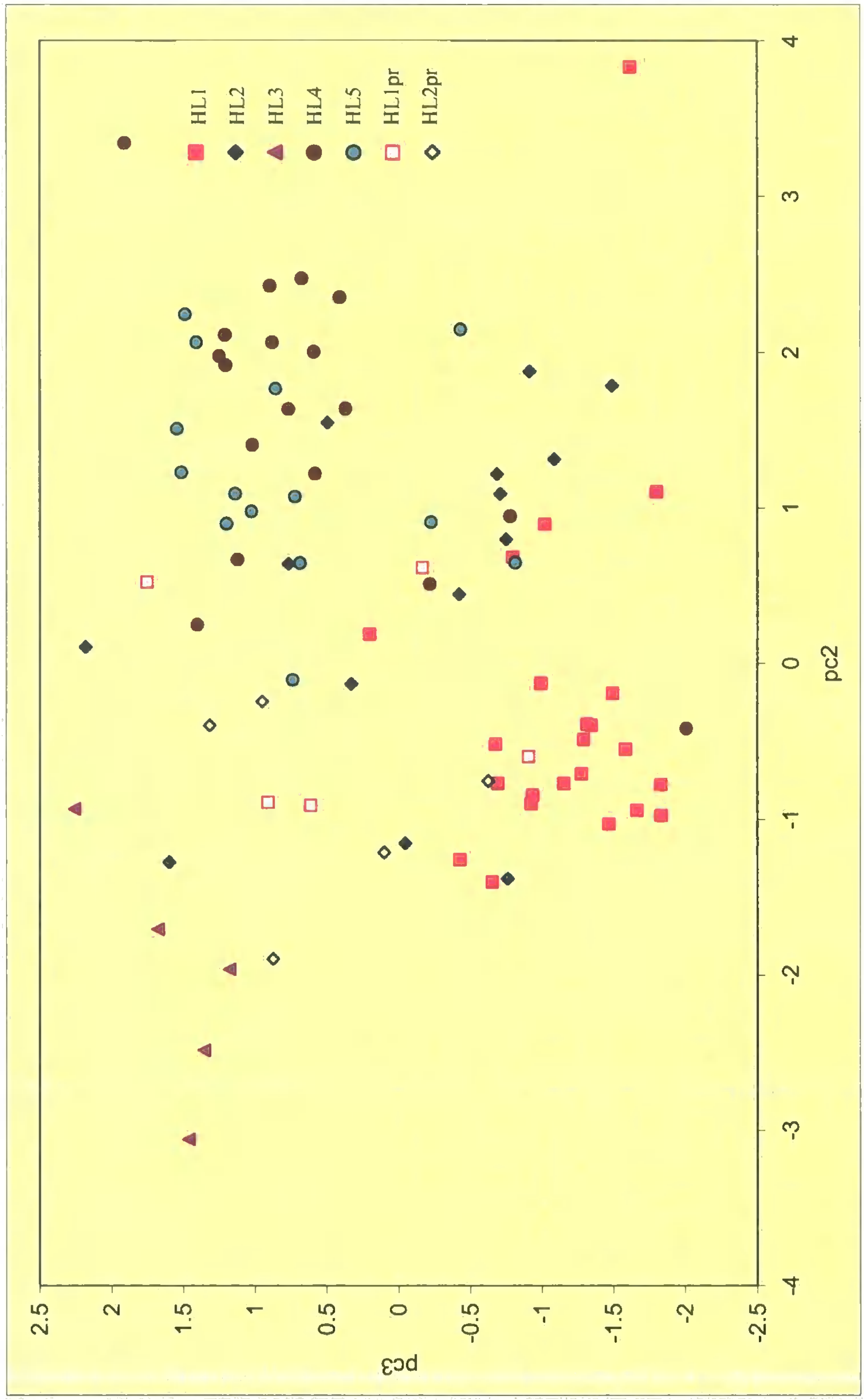


Figure 4.5 b) Heinrich layers from SU90-09. Principal component 2 plotted against principal component 3. pr –precursor.

Figure 4.5 c) Heinrich layers from SU90-09. Principal component 1 plotted against principal component 3. pr –precursor.

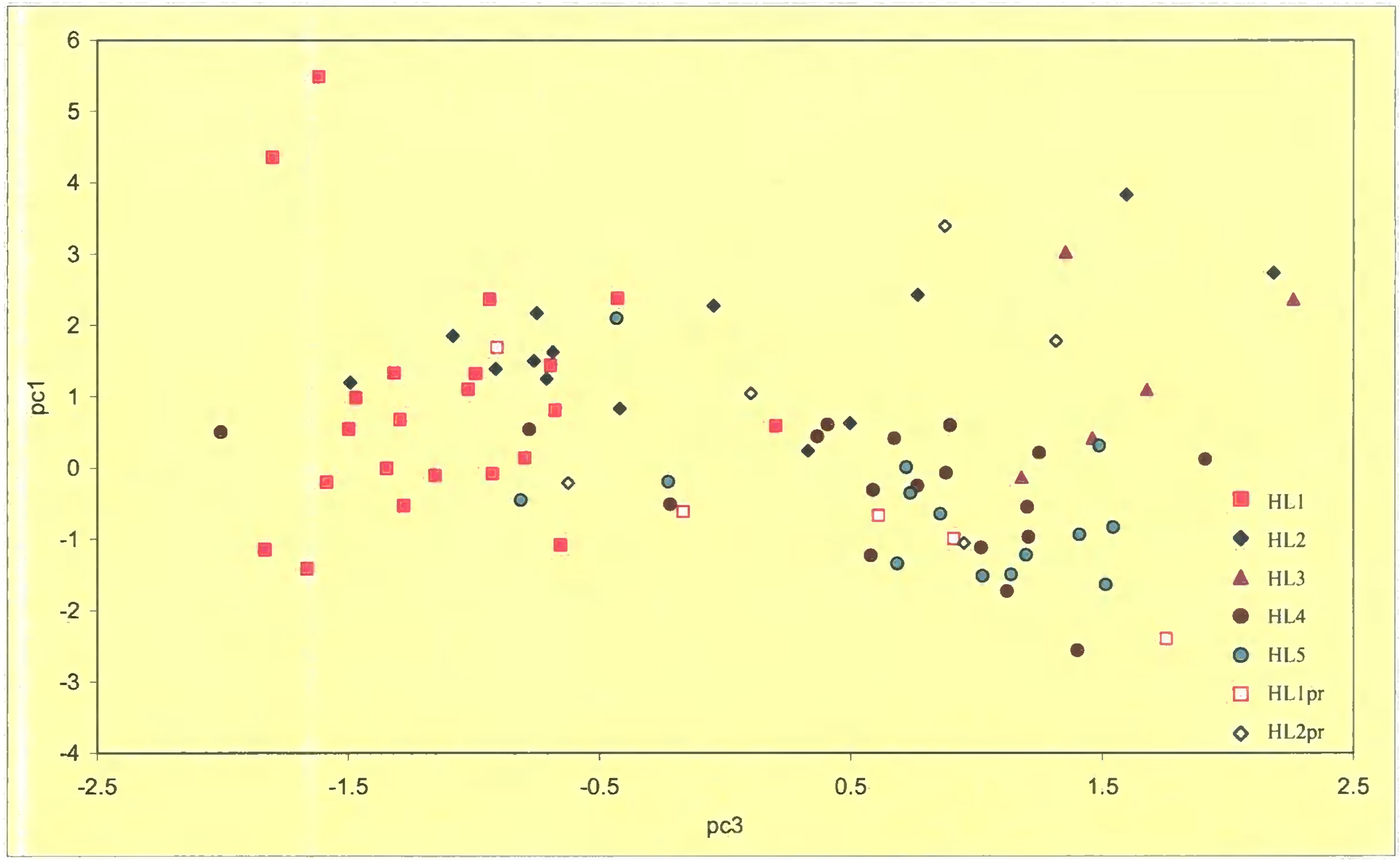


Figure 4.6 Pristane/phytane and isoprenoid ratios for HL4 and HL5 from SU90-09.

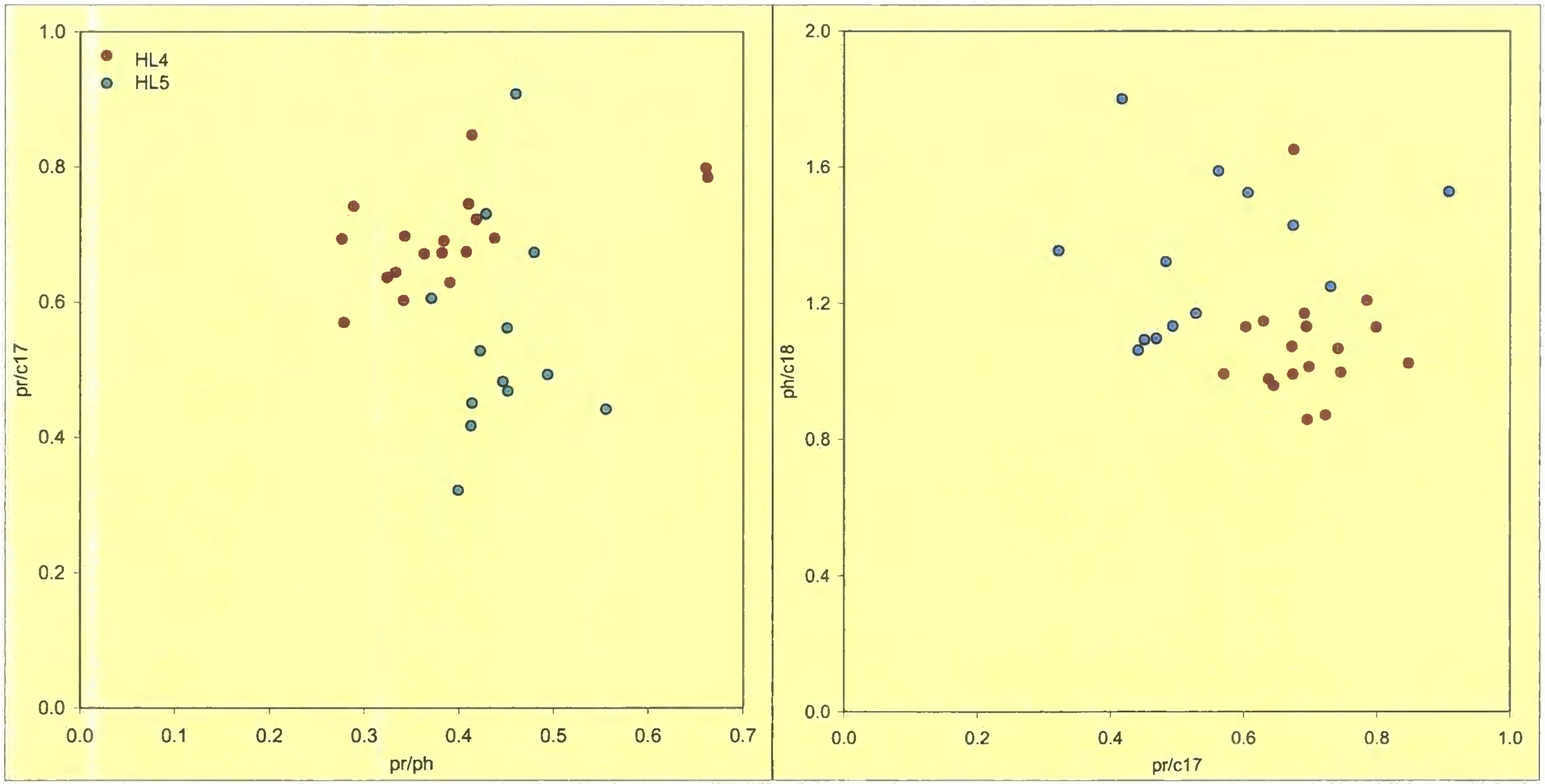


Figure 4.7 **a)** CPI_{24-31} plotted against nC_{29}/nC_{31} to illustrate difference between HL2 and HL4 of the core SU90-09.
b) nC_{29}/nC_{31} plotted against ACL to illustrate similarity between HL1 and HL2 precursor events of the core SU90-09.

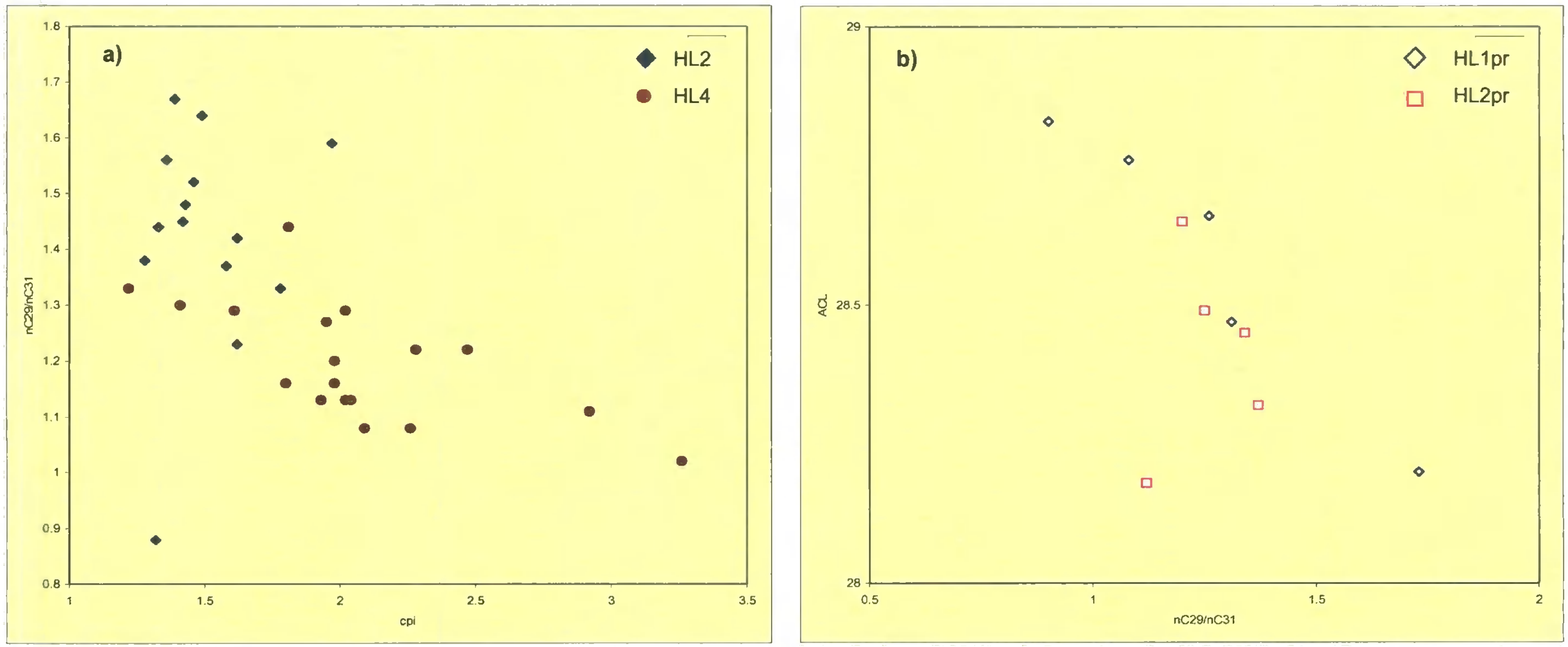


Figure 4.8 Relative abundance of photosynthetic pigments in Heinrich layers and ambient glacigenic sediments of the core MD95-2024. Concentration of porphyrins was calculated as peak height at 550 nm (Ni) and 570 nm (VO) on the absorption spectra per gram dry sediment (mAU/g – milli absorption units per gram). LDC – Low detrital carbonate layer (Stoner *et al.*, 1998)

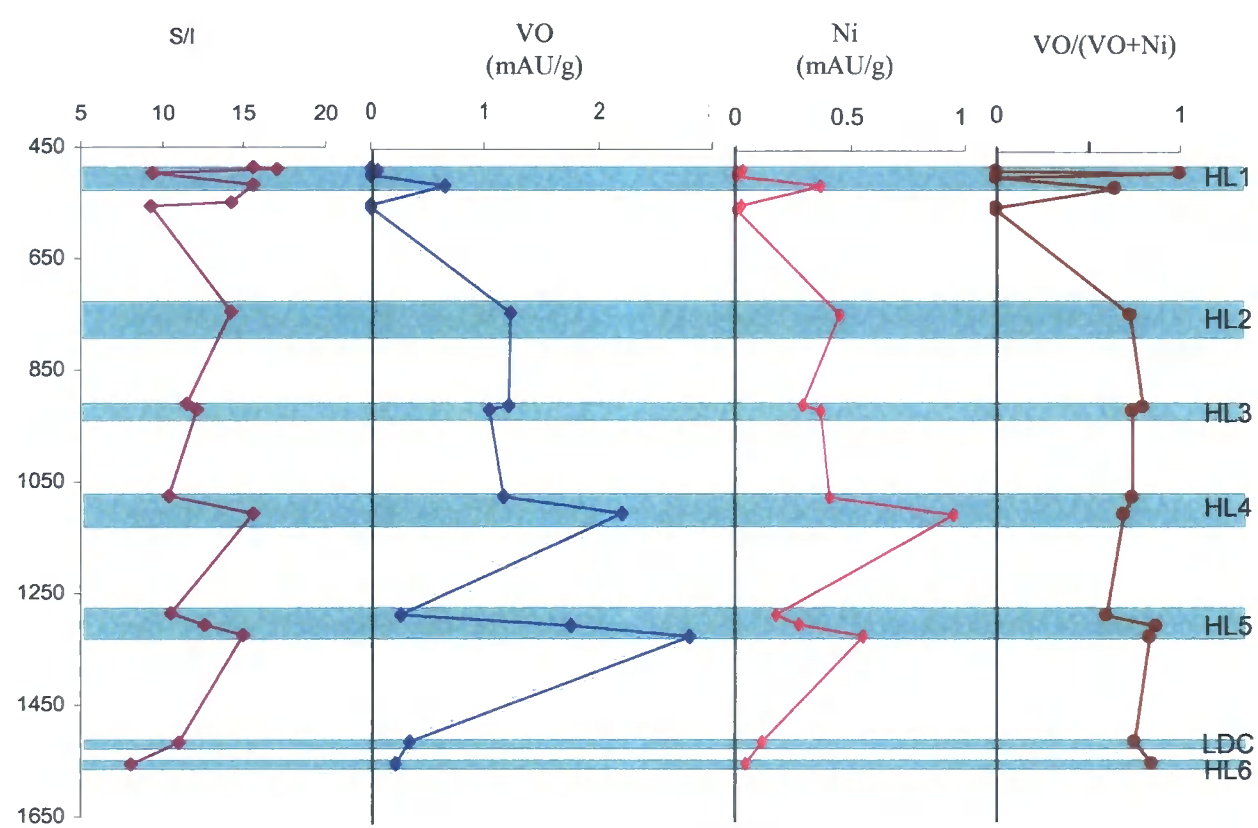


Figure 4.9 Relative abundance of photosynthetic pigments in Heinrich layers and ambient glacigenic sediments of the core ODP 609. Concentration of porphyrins was calculated as peak height at 550 nm (Ni) and 570 nm (VO) on the absorption spectra per gram dry sediment (mAU/g – mili absorption units per gram). Note different scale for VO and Ni porphyrins concentration from MD95-20224.

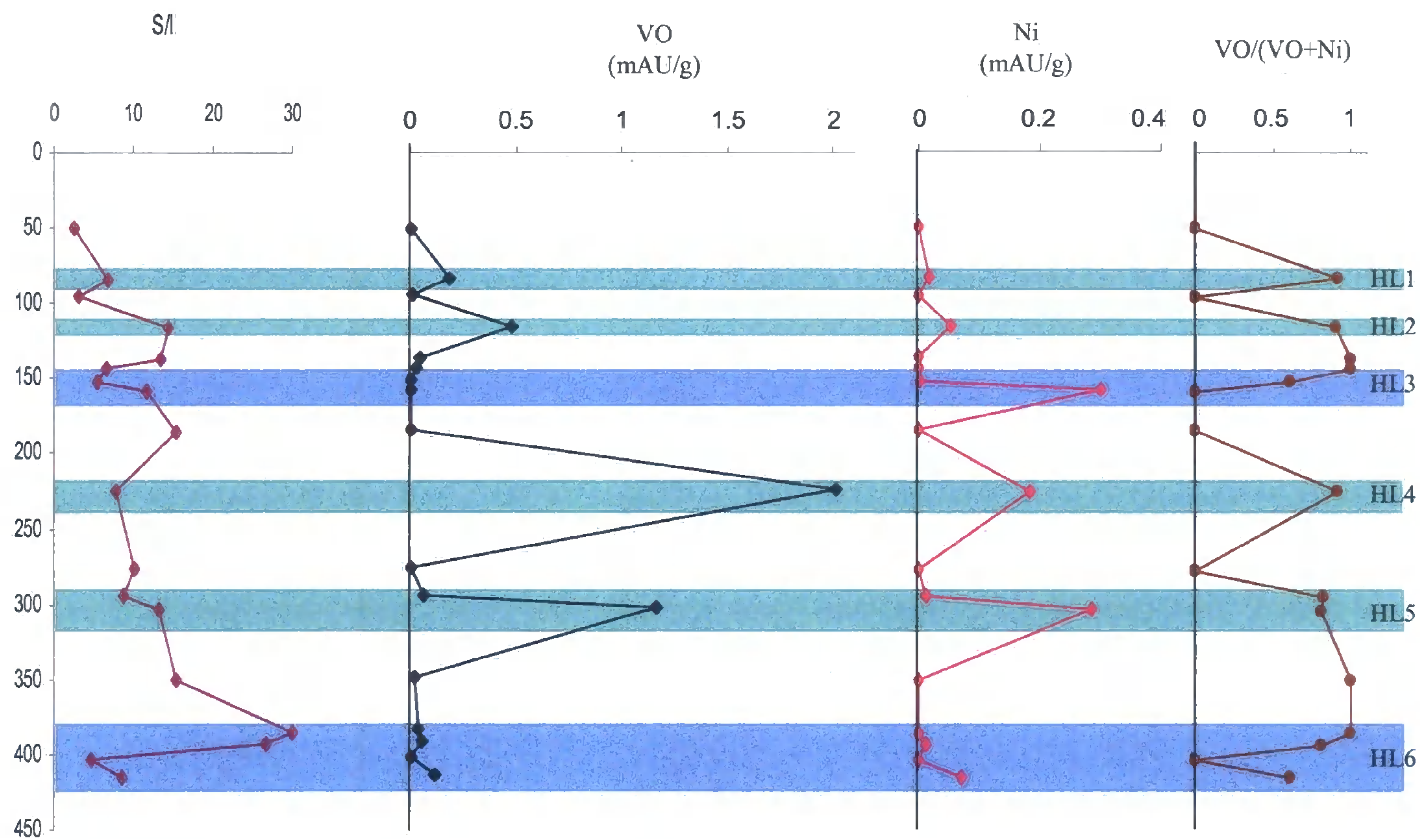


Figure 4.10 Gas chromatograms of the representative samples of the HL sediments from "typical (HL2)" and "untypical" (HL3) Heinrich layers.

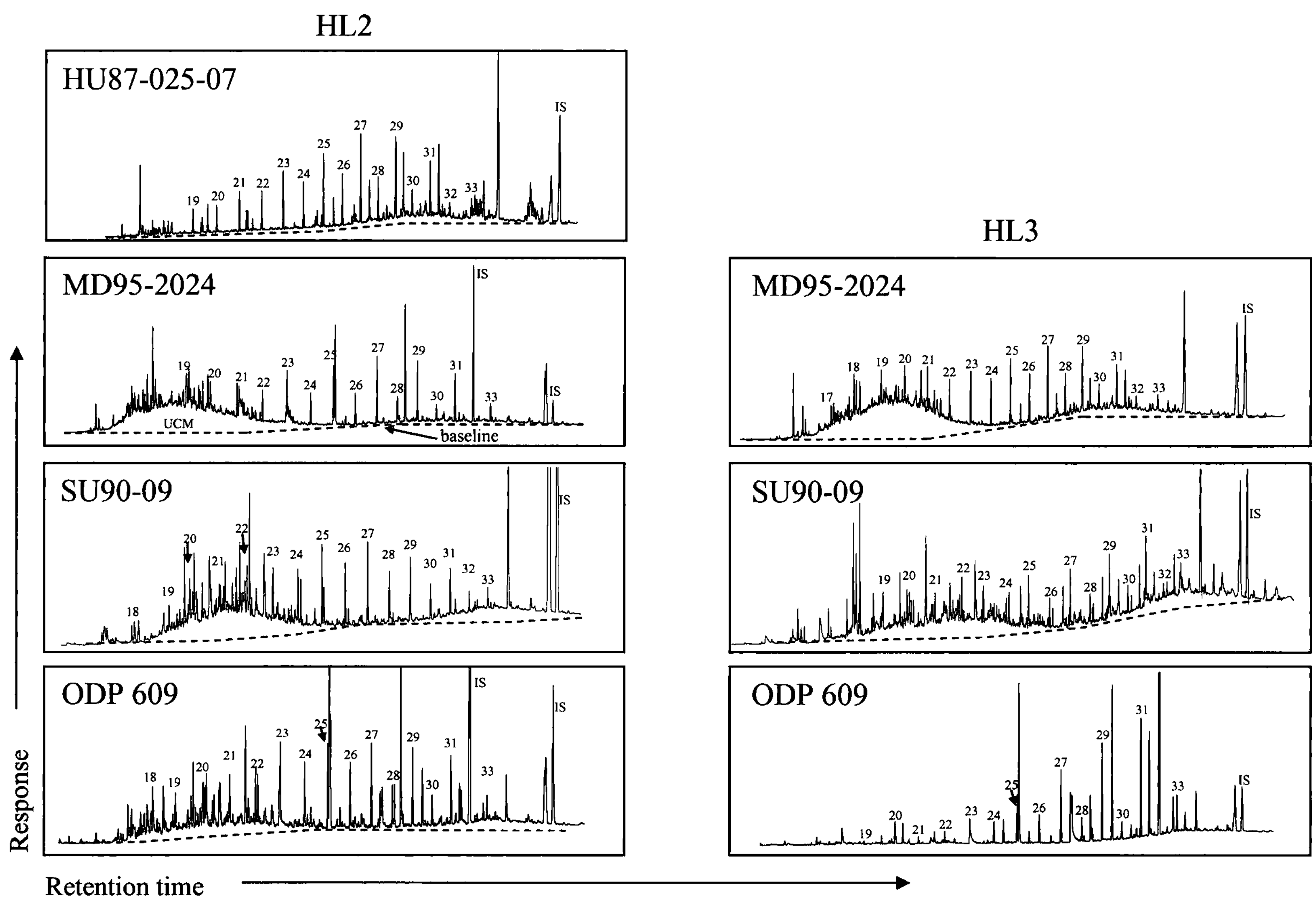


Figure 4.11 Chain-length distributions of n-alkanes in representative samples of "typical"(HLs 1, 2, 4 &5), "untypical" (HLs 3 & 6) HLs with average values for Carbon preference index ($CPI_{24\text{-}31}$), average chain length ($ACL_{25\text{-}33}$) and relative abundance of long-chain n-alkanes.

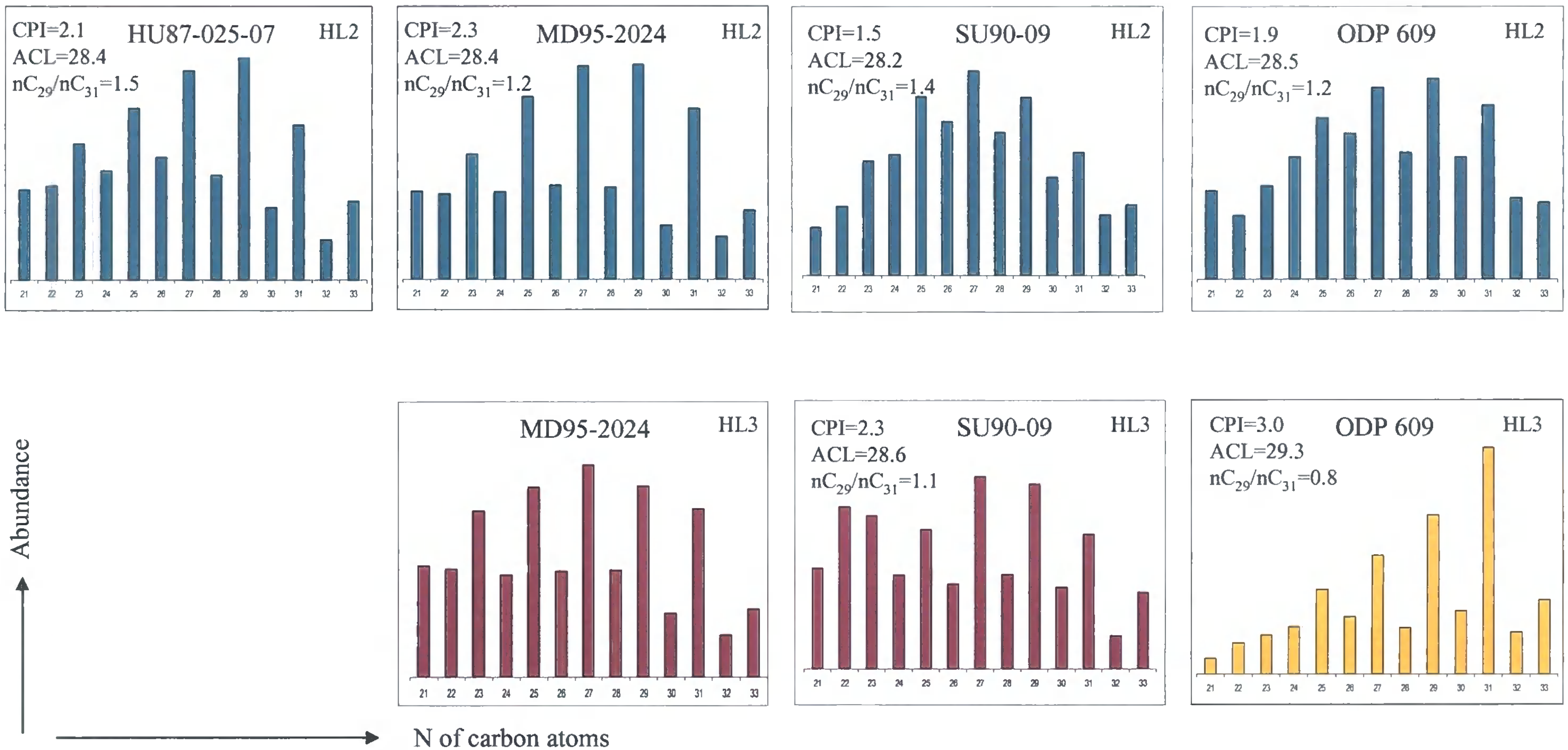


Figure 4.12 Heinrich layer samples from "typical" and "untypical" Heinrich Layers from different locations in the North Atlantic. Principal component 1 plotted against principal component 2.

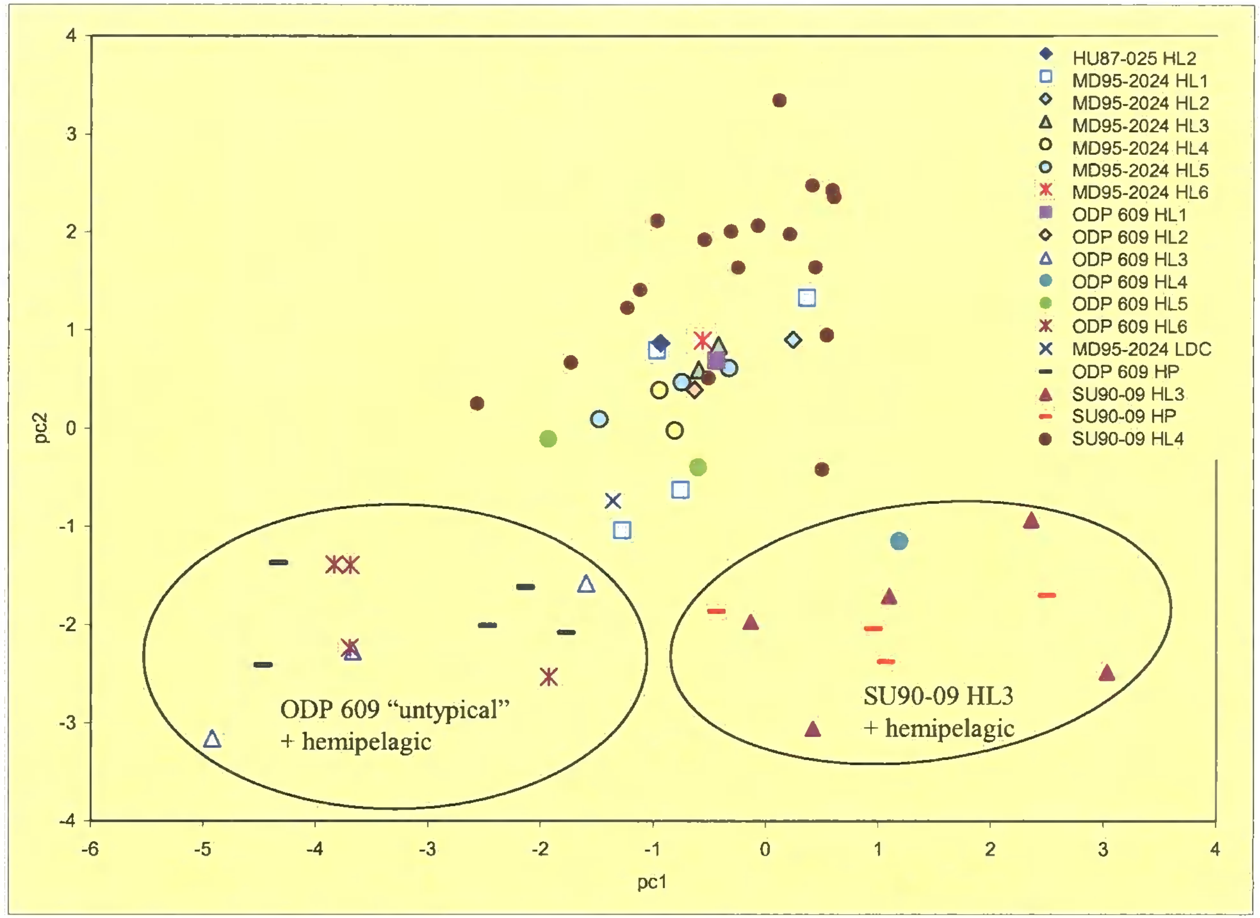


Figure 4.13 a) Heinrich layer samples from different areas. Principal component 1 plotted against principal component 2.

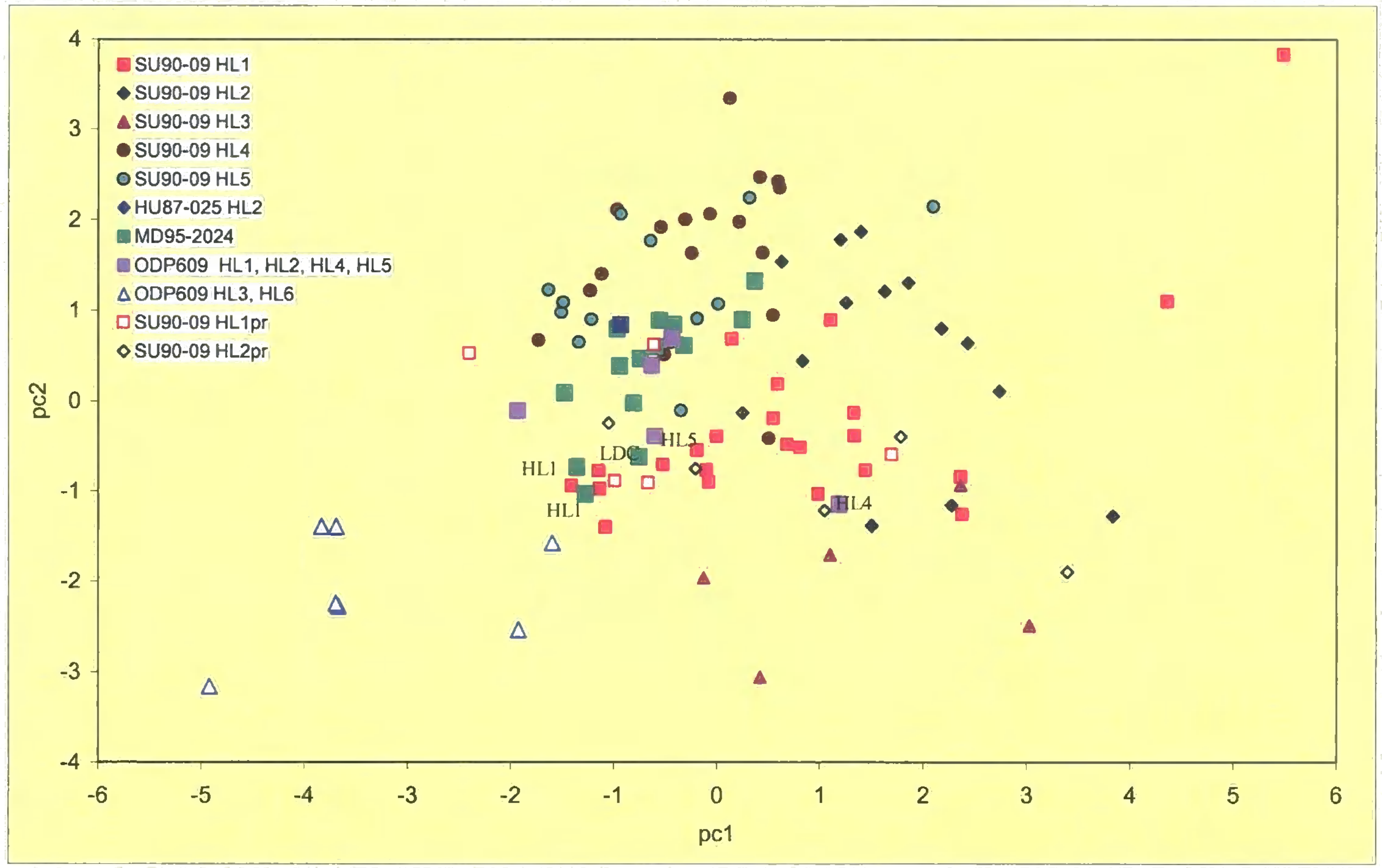


Figure 4.13 b) Heinrich layer samples from different areas. Principal component 2 plotted against principal component 3.

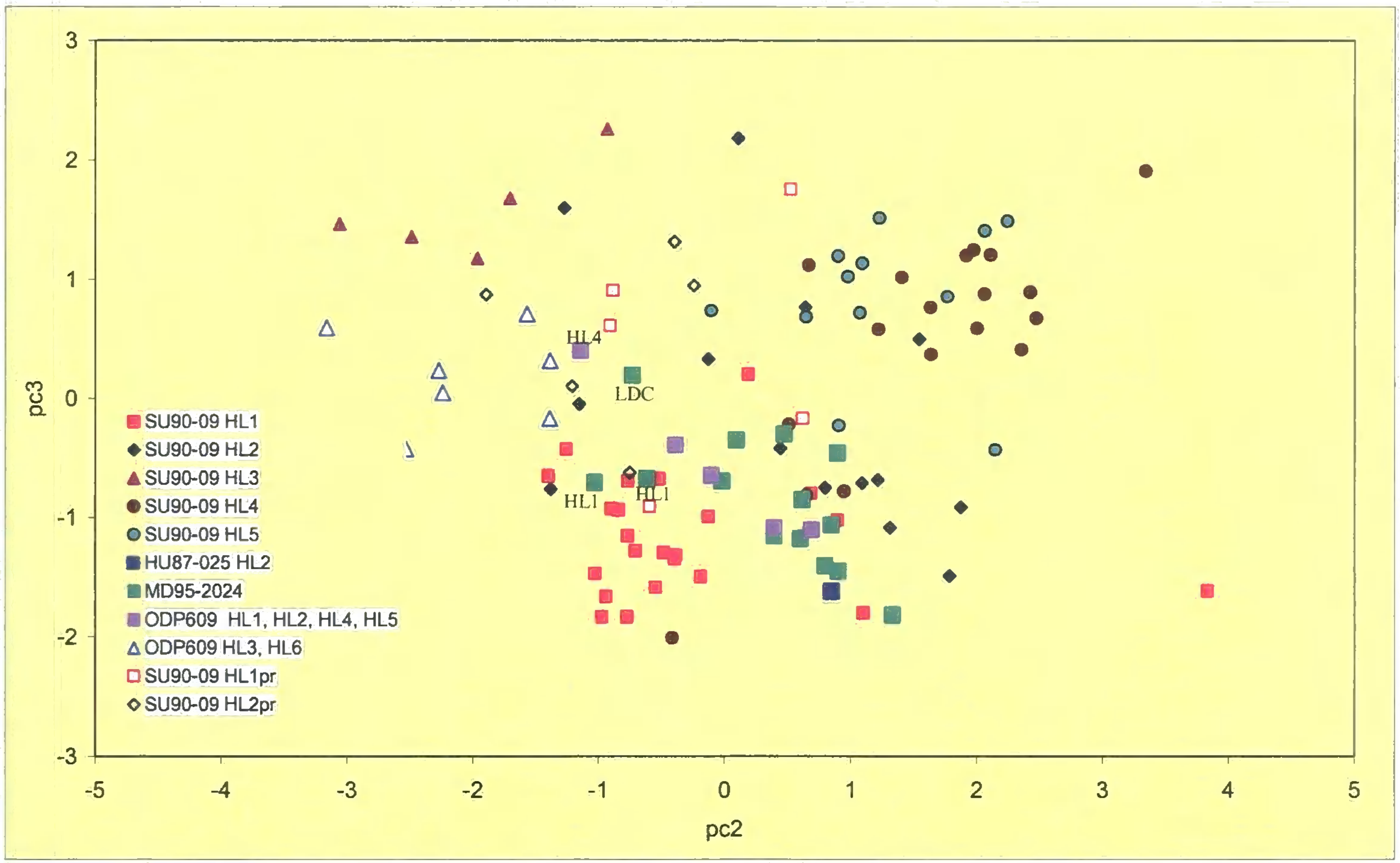


Figure 4.13 c) Heinrich layer samples from different areas. Principal component 1 plotted against principal component 3.

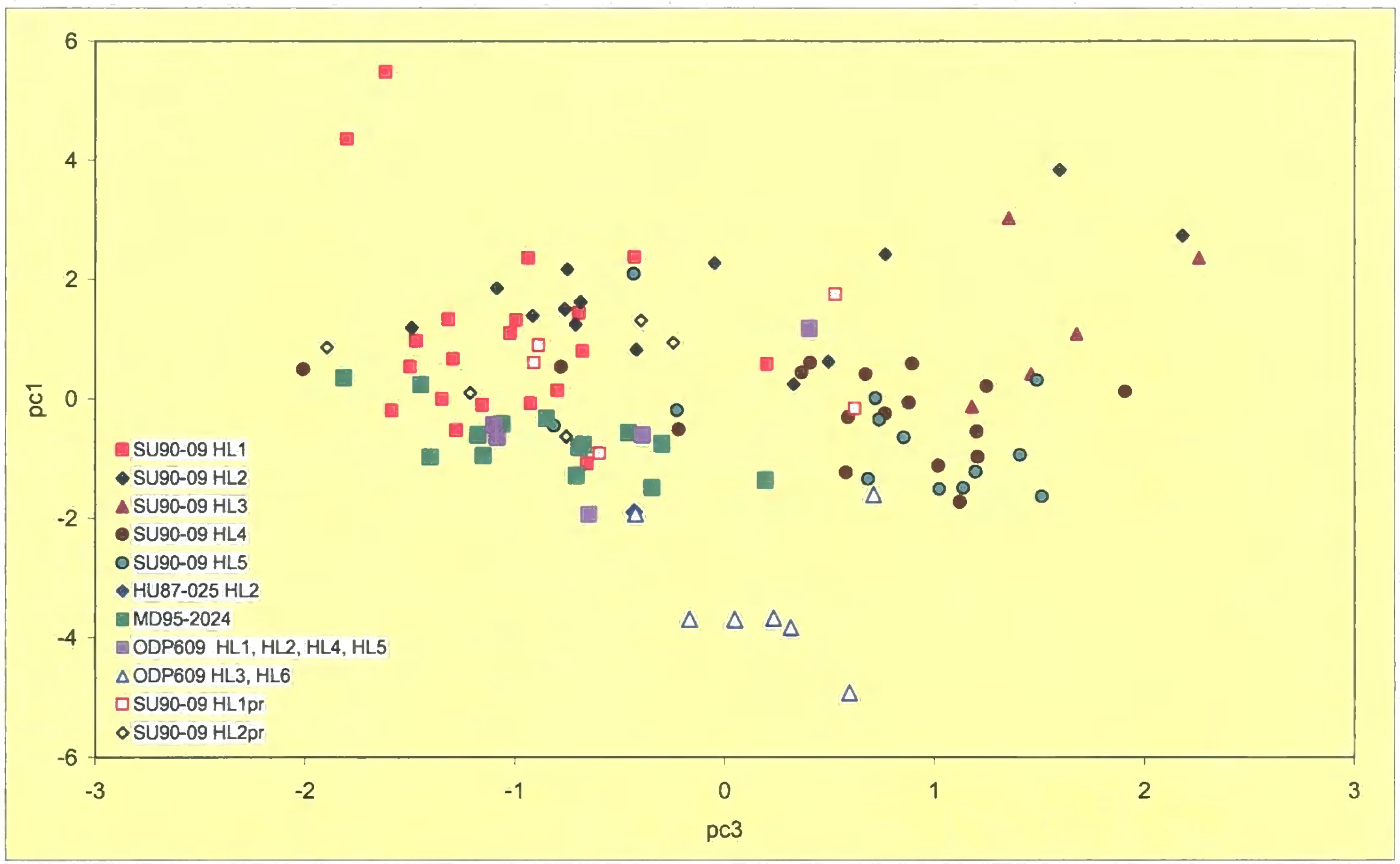


Figure 4.14 Gas chromatograms of the saturated fraction of the representative samples from potential sources of IRD. N-alkanes are marked with numbers corresponding to the number of carbon atoms. IS – internal standard.

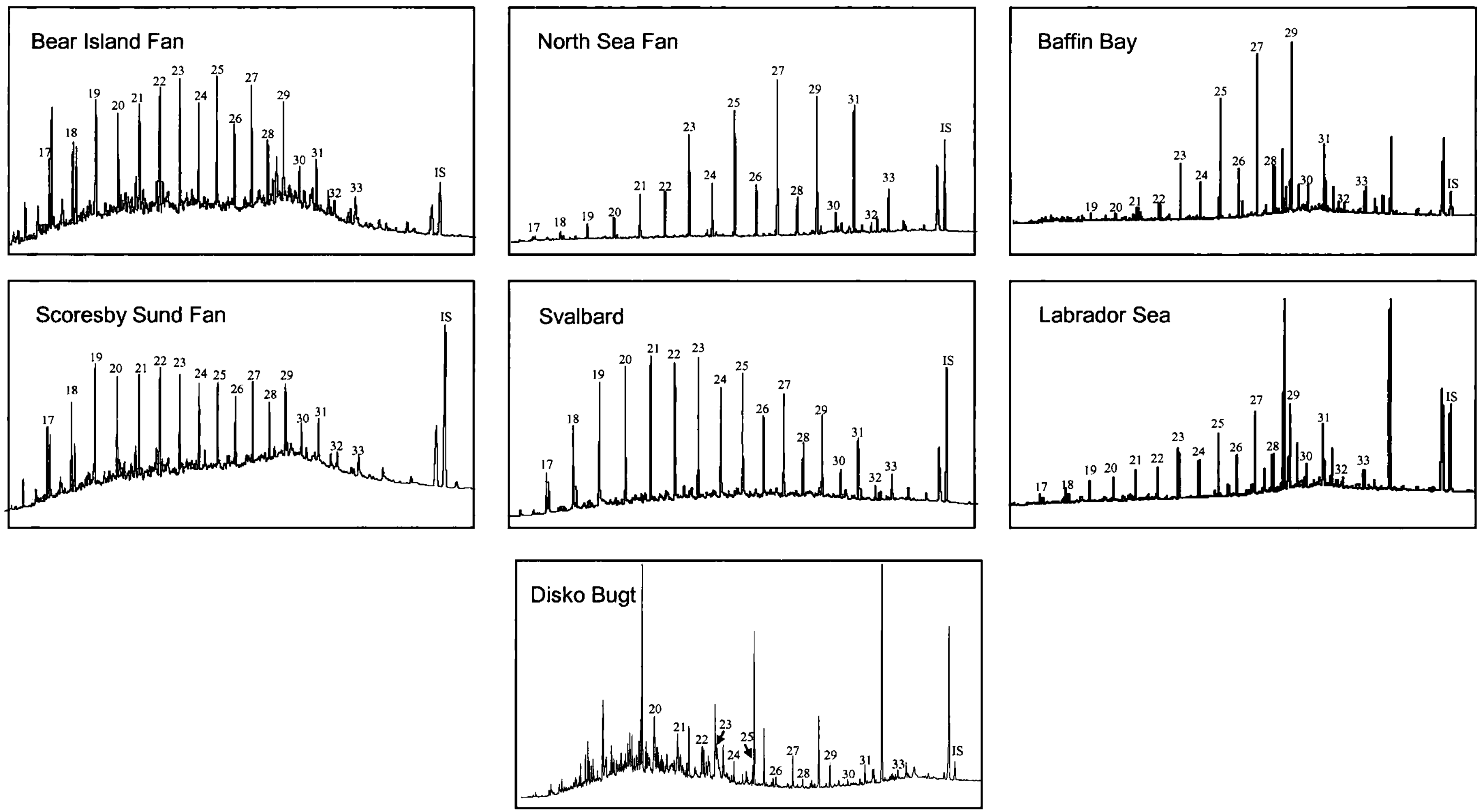
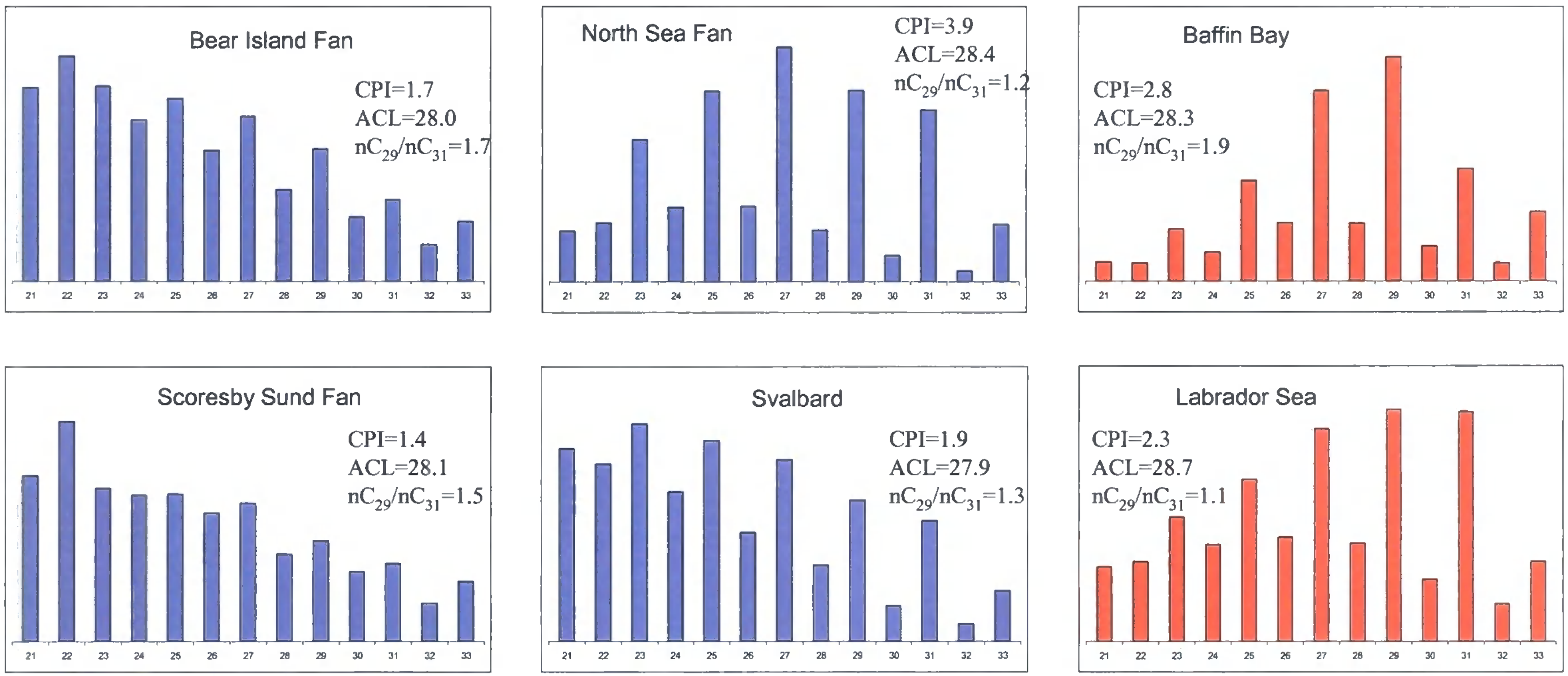


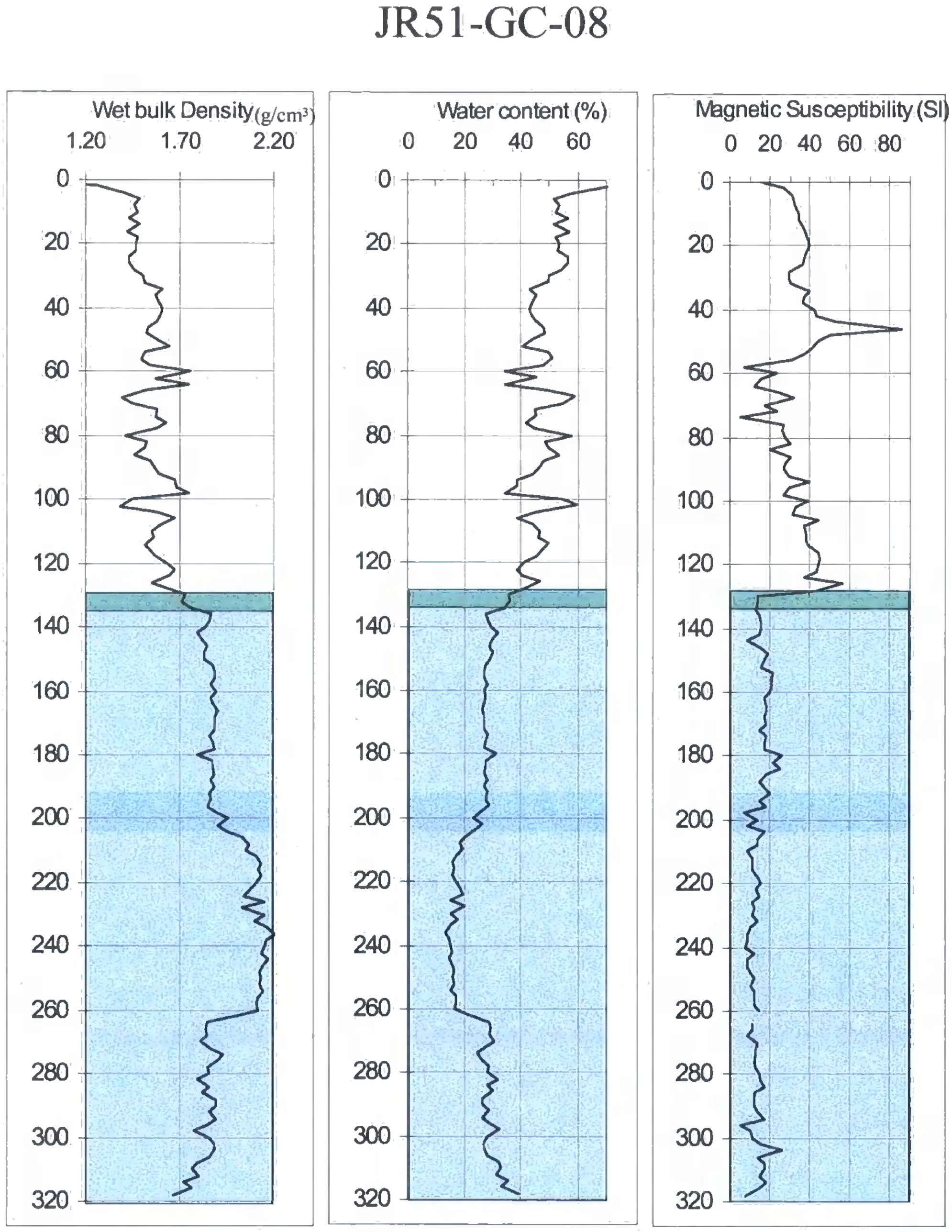
Figure 4.15 Chain-length distributions of n-alkanes in representative samples of potential sources of IRD with average values for Carbon preference index (CPI_{24-31}), average chain length (ACL_{25-33}) and relative abundance of long-chain n-alkanes.



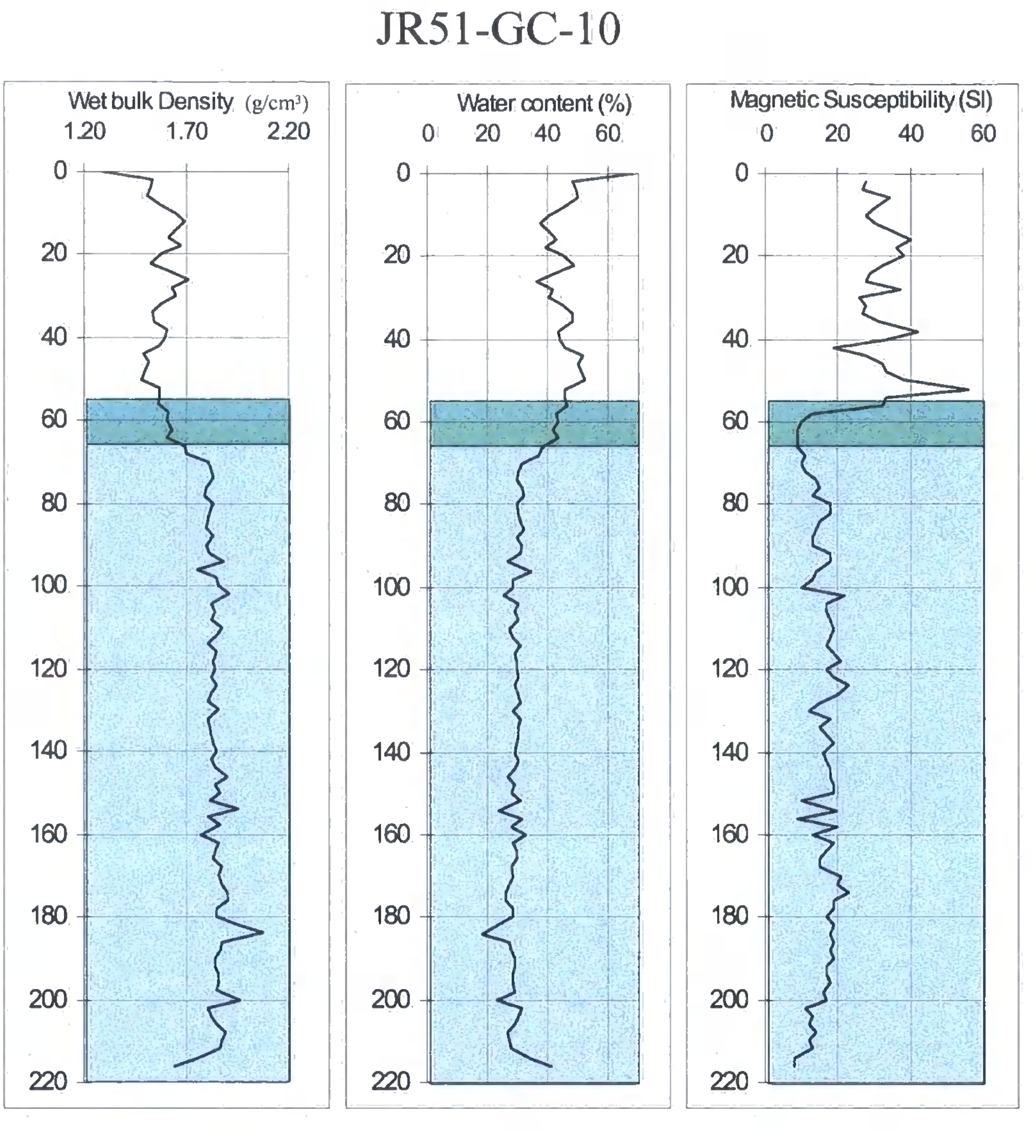
Appendix 1. Special laboratory equipment

- MARS 5 microwave accelerated reaction system equipped with Greenchem pressure vessels with 100 ml Teflon liners was used for microwave-assisted extraction (MAE) of sediment samples. MAE allows to process up to 14 samples simultaneously (20g of sediment maximum) at controlled temperatures with magnetic stirring.
- Labconco Centrivap® concentrator was attached to a cold trap unit (Labconco Corporation, Kansas City, Missouri 64132, USA) and a KNF Laboport vacuum pump (KNF Neuberger, UK). The system eliminates solvent from a sample by evaporation at low pressure. Centrifugal force prevents bumping and heating can be applied to speed the process. Typically, a negative pressure of 8-10 bar was used for ~20 minutes without heating (to remove DCM) and then with heating to 45 °C to eliminate MeOH. Up to 36 samples could be processed simultaneously.
- A custom built vacuum chamber was attached to a cold trap unit (as above) and an Edwards RV5 Vacuum pump (Edwards, Crawley, Sussex, UK). The system eliminates water from a sediment sample by sublimation at low pressure (lyophilization or "freeze drying"). The system had the advantage that hundreds of samples could be dried during ~48 hrs.
- A vacuum manifold (Alltech, Carnforth, UK) with nitrogen blow-down was attached to a water pump and cold trap. This unit was used for removal of small volumes of solvent from GC vials.
- A Grant Boekel BBA Block heater (Grant Instruments Ltd, Cambridge, UK) was fitted with a custom made manifold for nitrogen blow-down. This unit was used as an alternative to the Labconco Centrivap for the elimination of solvent from up to 24 test tube samples.

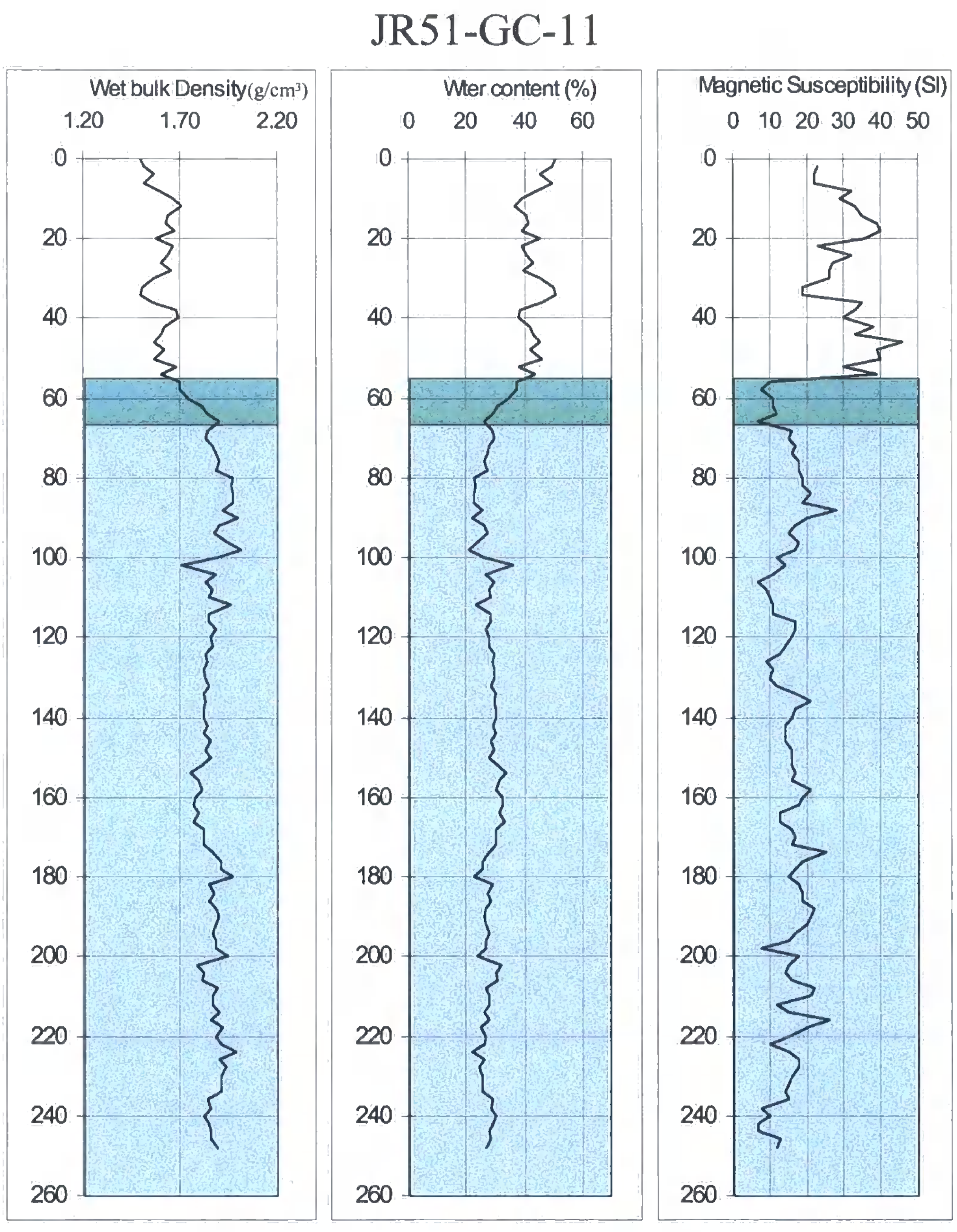
Appendix 2 a). Wet bulk density, water content and magnetic susceptibility of the sediments in the core JR51-GC08. Green shaded area marks dark grey mud (IRD) and blue shaded area marks debris flows sediments.



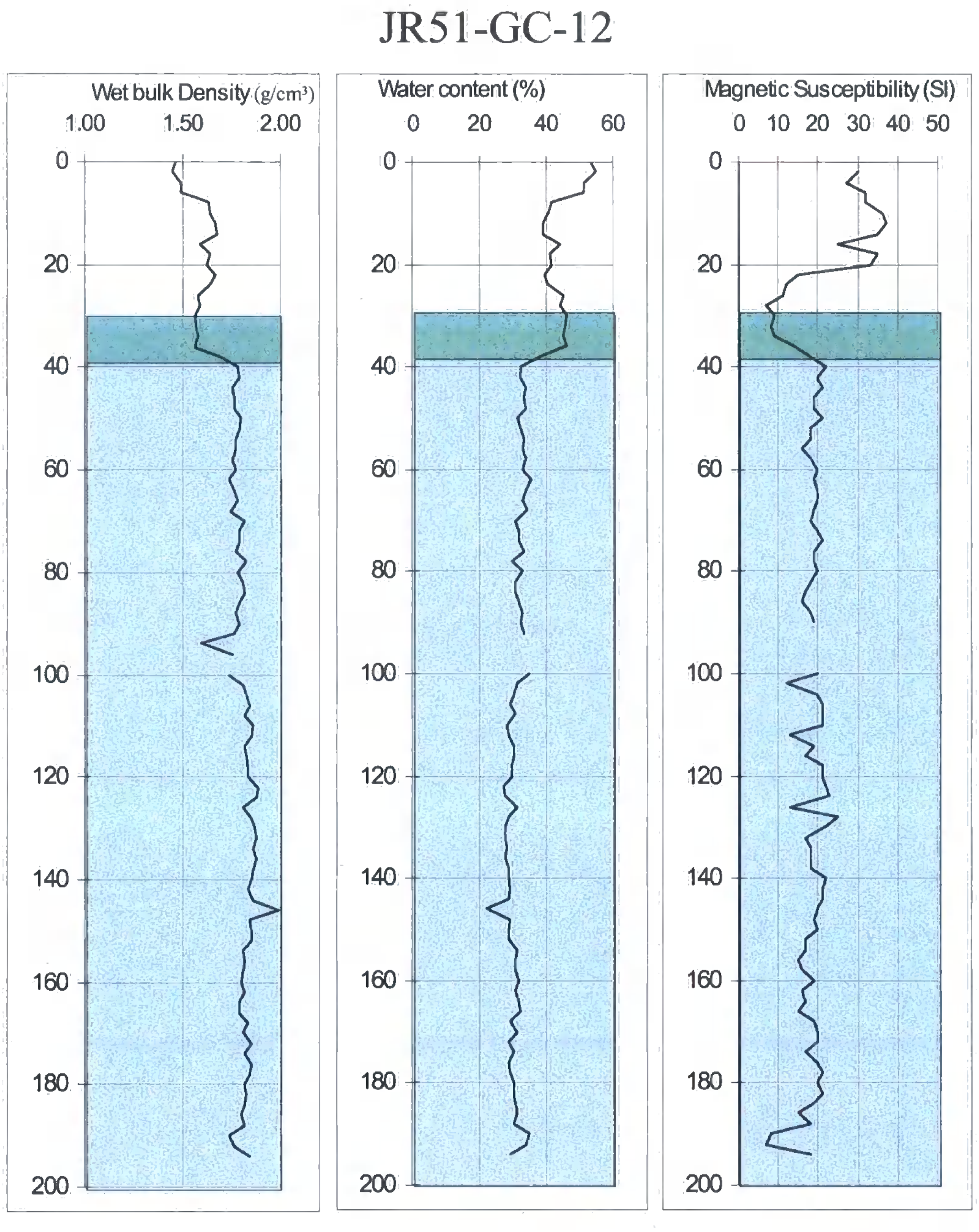
Appendix 2 b). Wet bulk density, water content and magnetic susceptibility of the sediments in the core JR51-GC10. Green shaded area marks dark grey mud (IRD or GDF) and blue shaded area marks debris flows sediments.



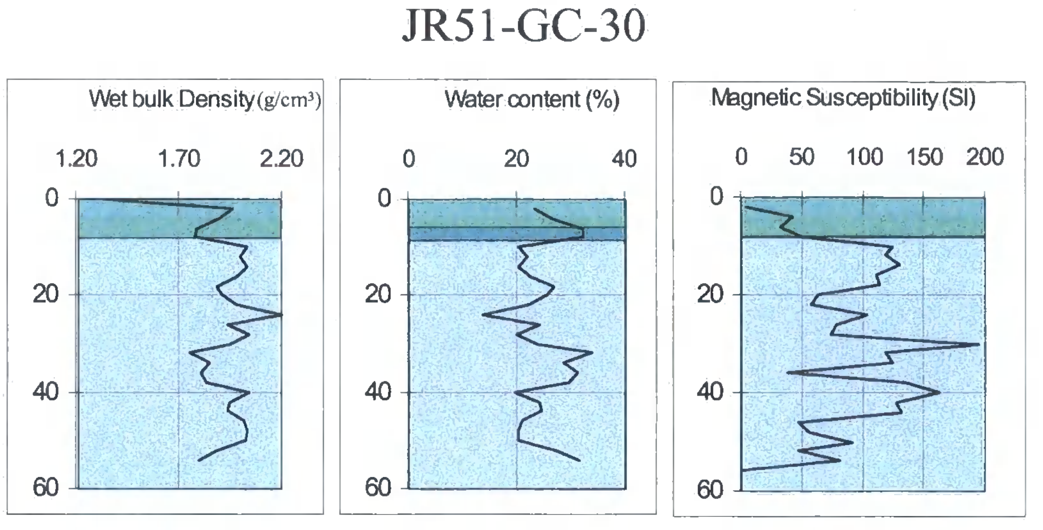
Appendix 2 c). Wet bulk density, water content and magnetic susceptibility of the sediments in the core JR51- GC11 . Green shaded area marks dark grey mud (IRD or GDF) and blue shaded area marks debris flows sediments.



Appendix 2 d). Wet bulk density, water content and magnetic susceptibility of the sediments in the core JR51- GC12. Green shaded area marks dark grey mud (IRD or GDF) and blue shaded area marks debris flows sediments.

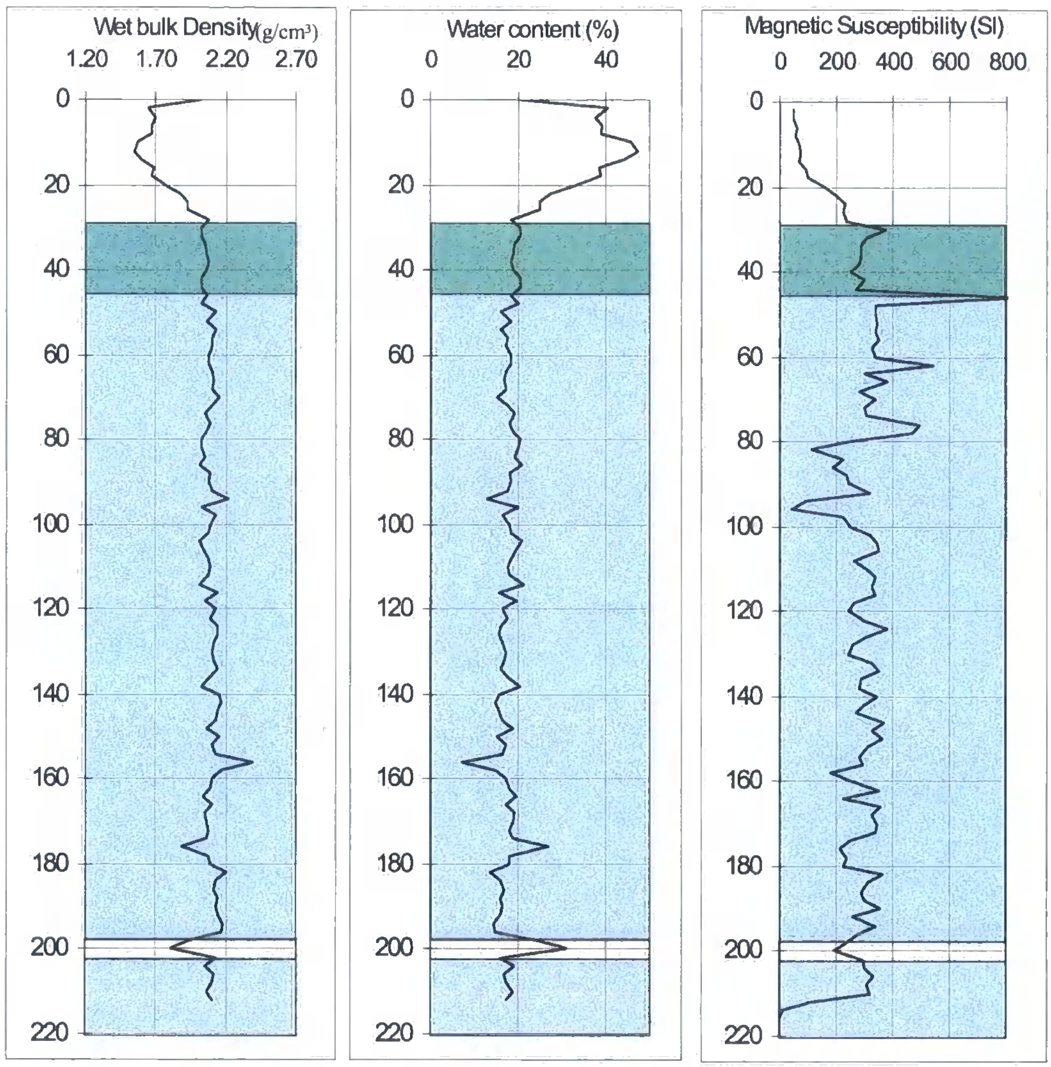


Appendix 2 e). Wet bulk density, water content and magnetic susceptibility of the sediments in the core JR51- GC30. Green and blue shaded areas mark glacial till sediments.

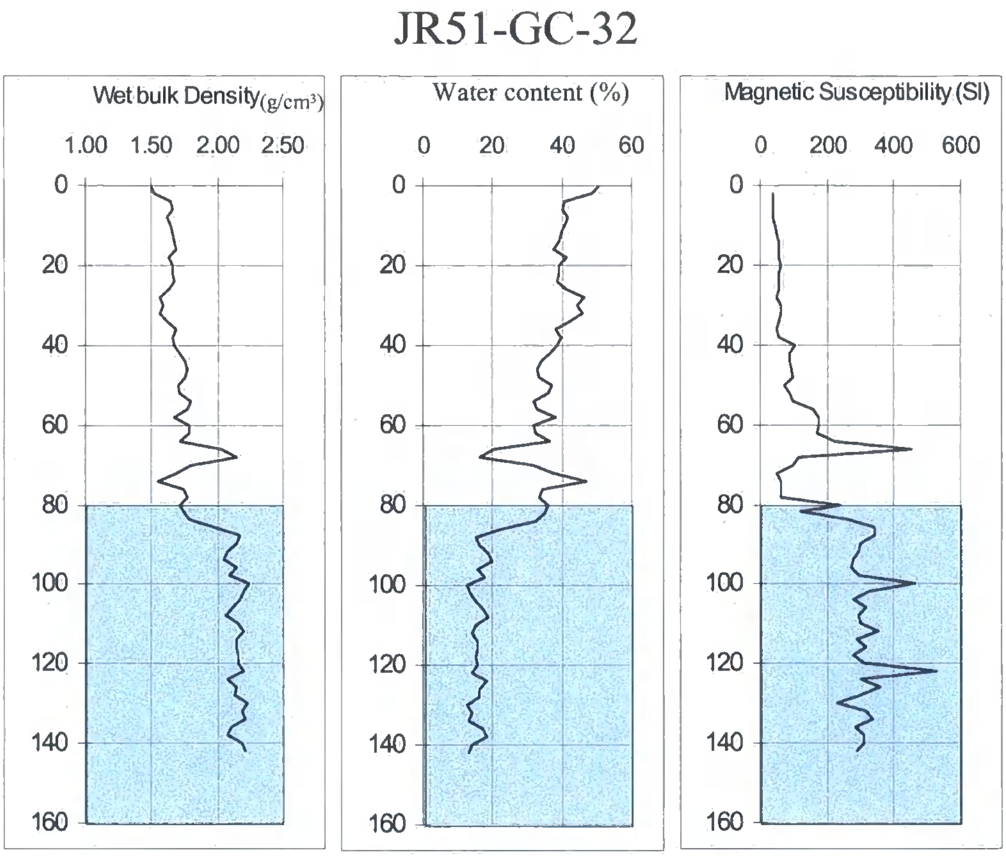


Appendix 2 f). Wet bulk density, water content and magnetic susceptibility of the sediments in the core JR51- GC31 . Shaded areas mark debris flows sediments.

JR51-GC-31



Appendix 2 g). Wet bulk density, water content and magnetic susceptibility of the sediments in the core JR51- GC32. Green and blue shaded areas mark debris flows sediments.



Appendix3

Biomarker analysis data for hemipelagic (HP), glacigenic debris flow (GDF), glacial till (GT) glacimarine (GM) and Heinrich layer (H) sediments. TNA - total n-alkanes, CPI - carbon preference index, UCM - unresolved complex mixtue, C27/C29 & C29/C31 - relative abundances of long-chain n-alkanes (n-C27-31), %(C29-C31) =SUM(n-C27-n-C31)/SUM(n-C17-nC19+n-C27-nC-31), S/I - relative abundance of porphyrins, VO/(VO+Ni) - relative abundance of vanadyl porphyrins, ACL - everage chain length.

Df fan	type of sed	Sample	TNA, ng/g	CPI 17-23	CPI 24-31	UCM/g, ng/g	UCM/TNA	C27/C29	C29/C31	%(C29-C31)	S/I	VO/(VO+Ni)	ACL25-33
BIF	HP	JR51-GC08-0-3	1411	1.37	3.10	0	0.00	1.16	1.23	87.07	10.75	0.00	29.06
BIF	DF	JR51-GC08-130-133	5259	1.16	1.50	47390	9.01	1.20	1.66	49.14	38.48	0.78	28.09
BIF	DF	JR51-GC08-143-147	7839	1.05	1.61	83721	10.68	1.16	1.93	42.85	34.76	0.60	28.09
BIF	DF	JR51-GC08-222-225	14354	1.18	1.73	145146	10.11	1.24	1.63	24.00	48.50	0.62	27.69
BIF	DF	JR51-GC08-300-303	12608	1.22	1.69	105162	11.28	1.23	1.46	40.77	17.35	0.55	27.82
BIF	HP	JR51-GC10-0-3	2343	1.29	2.49	0	0.00	0.76	0.77	83.41	10.69	0.00	28.02
BIF	DF	JR51-GC10-63-65	7822	1.20	1.51	67426	8.62	1.16	1.72	39.00	33.92	0.76	28.07
BIF	DF	JR51-GC10-77-79	10194	1.07	1.53	93993	9.22	1.23	1.76	32.97	36.14	0.58	27.88
BIF	DF	JR51-GC10-130-132	9714	1.18	1.52	84734	8.72	1.39	1.26	42.59	34.25	0.45	27.94
BIF	DF	JR51-GC10-190-192	9770	1.18	1.55	97789	10.01	1.35	1.80	36.51	28.11	0.70	27.92
BIF	HP	JR51-GC11-0-2	1107	1.26	2.68	0	0.00	0.90	1.01	86.17	20.48	0.00	28.79
BIF	DF	JR51-GC11-60-62	11935	1.23	1.53	73558	6.16	1.15	1.81	30.85	39.47	0.77	27.78
BIF	DF	JR51-GC11-75-77	8407	1.10	1.48	82975	9.87	1.22	1.73	37.40	18.09	0.57	27.97
BIF	DF	JR51-GC11-150-152	7899	1.17	1.55	75311	9.53	1.27	1.58	42.33	13.38	0.60	27.95
BIF	DF	JR51-GC11-230-232	7777	1.19	1.57	74341	9.56	1.20	1.54	44.13	18.45	0.68	28.02
BIF	HP	JR51-GC12-0-2	965	1.24	2.82	0	0.00	0.93	0.88	88.02	17.15	0.00	28.83
BIF	DF	JR51-GC12-34-35	4530	1.25	2.09	30161	6.66	1.23	1.43	62.92	35.44	0.12	28.05
BIF	DF	JR51-GC12-48-50	5073	1.14	1.96	51399	10.13	1.09	1.74	54.63	29.69	0.49	28.11
BIF	DF	JR51-GC12-120-122	5295	1.10	2.04	48774	9.21	1.20	1.61	52.39	17.56	0.73	28.14
BIF	DF	JR51-GC12-180-182	5611	1.16	1.89	57167	10.19	1.29	1.74	53.08	28.93	0.38	27.98
SSF	GT	JR51-GC30-0-2	1592	1.12	1.63	12105	7.60	1.09	1.35	72.14	10.99	0.68	28.23
SSF	GT	JR51-GC30-18-20	2126	1.06	1.30	32109	15.10	1.37	1.29	44.99	20.76	0.65	28.11
SSF	GT	JR51-GC30-30-32	2292	1.04	1.25	30165	13.16	1.07	1.49	37.20	19.53	0.81	28.34
SSF	GT	JR51-GC30-50-52	2716	1.02	1.32	40737	15.00	1.22	1.45	45.48	21.26	0.77	28.02
SSF	HP	JR51-GC31-0-2	1899	1.45	4.10	0	0.00	0.74	0.95	95.74	11.87	0.00	29.01
SSF	DF	JR51-GC31-40-42	874	1.03	1.37	9462	10.83	1.13	1.25	59.37	15.92	0.46	28.25
SSF	DF	JR51-GC31-55-57	4218	1.16	1.58	37305	8.85	1.12	1.72	51.06	4.16	0.46	28.07
SSF	DF	JR51-GC31-30-32	1183	0.98	1.42	15615	13.20	1.17	1.25	45.09	32.22	0.43	28.23
SSF	DF	JR51-GC31-210-212	1043	1.03	1.41	14086	13.51	1.12	1.29	47.40	16.96	0.48	28.28
SSF	HP	JR51-GC32-0-2	2940	1.52	2.30	0	0.00	0.92	1.18	93.74	10.89	0.00	28.52

Appendix3 continued. Biomarker analysis data for hemipelagic (HP), glacigenic debris flow (GDF), glacial till (GT) glacimarine (GM) and Heinrich layer (H) sediments. TNA - total n-alkanes, CPI - carbon preference index, UCM - unresolved complex mixtue, C27/C29 & C29/C31 - relative abundances of long-chain n-alkanes (n-C27-31), %(C29-C31) =SUM(n-C27-n-C31)/SUM(n-C17-nC19+n-C27-nC-31), S/I - relative abundance of porphyrins, VO/(VO+Ni) - relative abundance of vanadyl porphyrins, ACL - everage chain length.

Df fan	type of sed	Sample	TNA, ng/g	CPI 17-23	CPI 24-31	UCM/g, ng/g	UCM/TNA	C27/C29	C29/C31	%(C29-C31)	S/I	VO/(VO+Ni)	ACL25-33
SSF	GM	JR51-GC32-74-75	2968	1.44	3.52	8785	2.96	0.94	1.07	87.24	23.00	0.63	28.59
SSF	DF	JR51-GC32-90-92	1359	1.09	1.39	11039	8.12	1.05	2.00	51.50	27.94	0.53	28.16
SSF	DF	JR51-GC32-120-122	2262	0.93	1.34	21989	9.72	1.16	1.59	26.10	26.15	0.53	27.91
SSF	DF	JR51-GC32-140-142	3056	0.88	1.30	173819	56.87	1.65	1.31	24.52	25.18	0.50	27.55
NSF	DF	HM8303-170	6529	1.61	3.81	18876	2.89	1.38	1.16	89.33	8.66	0.31	28.32
NSF	DF	HM8303-220	7159	1.69	3.91	17711	2.47	1.43	1.20	90.96	8.55	0.28	28.30
NSF	DF	HM7908 230	10510	1.57	3.81	30640	2.92	1.57	1.24	84.46	8.43	0.24	28.09
NSF	DF	HM7908-260	8020	1.59	3.89	24743	3.09	1.15	1.25	90.43	9.79	0.42	28.40
NSF	GM	HM8306-62	2613	1.37	3.65	7953	3.04	1.01	1.06	92.38	10.74	0.00	28.55
NSF	DF	HM8306-72	7918	1.54	3.79	19838	2.51	1.31	1.08	88.12	6.85	0.23	28.45
NSF	DF	HM8306-84	5712	1.61	3.74	13977	2.45	1.23	1.10	91.01	7.78	0.36	28.58
NSF	DF	HM8306-94	7109	1.77	4.02	18656	2.62	1.33	1.15	95.51	7.12	0.37	28.50
NSF	DF	HM8306-114	6776	1.82	3.93	19899	2.94	1.36	1.10	96.70	6.79	0.34	28.53
NSF	DF	HM8306-124	5034	1.82	4.12	10979	2.18	1.22	1.11	97.57	6.79	0.52	28.39
SVALB	DF	ODP986B1H-2W-20	14737	0.94	2.01	97369	6.61	1.23	1.35	52.28	5.97	0.18	28.01
SVALB	DF	ODP986C1H-2W-20	16181	0.91	1.89	88079	5.44	1.47	1.31	40.33	4.82	0.52	27.70
SVALB	DF	ODP986A1H-20	16221	0.90	2.22	84611	5.22	1.29	1.17	45.35	9.41	0.45	27.97
SVALB	DF	ODP986B1H2W90	9330	0.77	1.66	48258	5.17	1.20	1.34	37.20	27.35	0.26	27.89
SVALB	DF	ODP986C1H2W90	2924	1.03	2.44	9010	0.98	0.87	0.95	86.67	22.80	0.70	28.74
SVALB	DF	ODP986A1H 90	9151	0.85	1.89	41278	14.12	1.30	1.25	48.50	9.13	0.64	27.89
LS	HP	HUHU87-25-7-5	14	1.47	1.91	0	0.00	0.89	1.02	86.58	4.69	0.00	28.56
LS	DF	HU87-25-7-15	88	1.31	2.23	227	2.57	0.89	1.10	88.14	11.44	0.90	28.64
LS	DF	HU87-25-7-20	92	1.37	2.18	332	3.60	0.89	0.93	90.13	13.16	1.00	28.82
LS	DF	HU87-25-7-25	29	1.38	2.37	70	2.38	0.83	0.82	94.20	11.50	1.00	29.04
LS	DF	HU87-25-7-30	82	1.29	2.54	284	3.46	0.92	1.01	82.26	13.51	1.00	28.68
LS	DF	HU87-25-7-50	284	1.36	2.04	584	2.06	0.97	1.15	92.54	11.44	1.00	28.59
LS	DF	HU87-25-7-65	255	1.74	2.47	859	3.37	0.86	0.85	89.32	12.36	1.00	28.99
LS	HP	HU88-24-2-15	39	1.55	2.05	266	6.80	0.99	1.41	86.72	12.48	0.00	28.37
LS	HI	HU88-24-2-20	187	1.39	1.99	1749	9.36	0.97	1.67	78.22	5.24	0.95	28.21

Appendix3 continued. Biomarker analysis data for hemipelagic (HP), glacigenic debris flow (GDF), glacial till (GT) glacimarine (GM) and Heinrich layer (H) sediments. TNA - total n-alkanes, CPI - carbon preference index, UCM - unresolved complex mixtue, C27/C29 & C29/C31 - relative abundances of long-chain n-alkanes (n-C27-31), %(C29-C31) =SUM(n-C27-n-C31)/SUM(n-C17-nC19+n-C27-nC-31), S/I - relative abundance of porphyrins, VO/(VO+Ni) - relative abundance of vanadyl porphyrins, ACL - everage chain length.

Df fan	type of sed	Sample	TNA, ng/g	CPI 17-23	CPI 24-31	UCM/g, ng/g	UCM/TNA	C27/C29	C29/C31	%(C29-C31)	S/I	VO/(VO+Ni)	ACL25-33
LS	HI	HU88-24-2-30b	136	1.38	1.59	788	5.81	1.00	1.20	79.22	7.91	1.00	28.70
LS	HI	HU88-24-2-40	74	1.14	1.80	928	12.55	1.05	1.65	81.22	6.17	1.00	27.96
BB	GM	HU77-27-2-102	3666	2.10	3.72	30079	8.21	0.97	2.44	89.33	14.84	0.22	28.19
BB	DF	HU77-27-2-103	3344	2.39	3.72	12079	3.61	1.00	2.49	89.05	18.46	1.00	28.11
BB	DF	HU77-27-2-113	5036	2.22	4.05	9294	1.85	0.89	1.94	95.83	10.49	0.66	28.44
BB	DF	HU77-27-2-118	977	1.89	3.55	7145	7.31	0.85	1.99	95.02	16.32	1.00	28.60
BB	DF	HU77-27-2-123	2833	2.98	3.62	6072	2.14	0.90	2.11	97.87	19.44	0.82	28.42
BB	DF	HU77-27-2-143	2875	2.06	2.64	8515	2.96	0.94	2.32	95.39	19.31	0.84	28.17
BB	GM	HU76-29-36-152	1416	1.89	2.15	7915	5.59	1.14	1.61	84.41	12.84	0.00	28.34
BB	DF	HU76-29-36-153	1911	2.15	2.38	8868	4.64	1.07	1.76	91.36	14.37	0.14	28.30
BB	DF	HU76-29-36-154	2723	1.79	2.02	14158	5.20	1.11	1.80	85.73	16.12	0.00	28.09
BB	DF	HU76-29-36-158	2327	1.81	1.92	10112	4.35	1.11	1.62	85.48	15.45	0.19	28.34
BB	DF	HU76-29-36-168	1085	2.10	2.31	2021	1.86	1.08	1.66	96.93	13.86	0.00	28.25
BB	DF	HU76-29-36-172	2118	2.16	2.07	9929	4.69	1.07	1.68	89.03	20.27	0.00	28.20
LS	H2	HU87-25-7-241B	513	1.38	2.05	2486	4.85	1.45	0.93	80.83	5.51	0.9	28.43
SWLS	H1	MD95-2024-0485	647	1.02	2.14	7477	11.55	1.07	0.85	78.52	15.62	0	28.71
SWLS	H1	MD95-2024-0490	655	1.16	1.39	3224	4.92	1.18	0.97	87.55	17.02	1	28.54
SWLS	H1	MD95-2024-0495	613	0.7	2.23	7591	12.39	1.07	1.02	84.14	9.44	0	28.54
SWLS	H1	MD95-2024-0515	1126	1.28	1.42	5161	4.59	1.34	1.17	92.32	15.53	0.68	28.06
SWLS	H2	MD95-2024-0745	604	1.29	1.7	8480	14.04	1.67	0.9	71.12	14.16	0.75	28.3
SWLS	H4	MD95-2024-1075	2297	1.17	2.39	4208	1.83	1.26	0.99	79.28	10.27	0.76	28.37
SWLS	H4	MD95-2024-1105	3425	1.09	2.55	10116	2.95	1.21	1	79.62	12.91	0.73	28.45
SWLS	H5	MD95-2024-1285	2813	0.95	2.44	6030	2.14	1.1	1.22	81.39	10.42	0.64	28.17
SWLS	H5	MD95-2024-1305	3061	1.16	2.91	4807	1.57	1.06	1.07	87.82	11.59	0.87	28.57
SWLS	H5	MD95-2024-1325	3818	1.21	3.46	8767	2.3	1.3	1.13	82.69	6.71	0.85	28.25
SWLS	IRD	MD95-2024-1515	3206	0.89	2.82	17844	8.05	1.04	0.86	90.56	11.01	0.75	28.65
SWLS	H3	MD95-2024-0910	2596	1.23	2.2	5630	2.17	1.25	1.09	70.72	20.04	0.83	28.22
SWLS	H3	MD95-2024-0920	2235	1.27	2.01	4310	1.93	1.13	1.11	76.85	11.75	0.76	28.31
SWLS	H6	MD95-2024-1555	1269	1.47	2.36	9767	7.69	1.09	1.16	79.01	10.53	0.88	28.26

Appendix3 continued. Biomarker analysis data for hemipelagic (HP), glacigenic debris flow (GDF), glacial till (GT) glacimarine (GM) and Heinrich layer (H) sediments. TNA - total n-alkanes, CPI - carbon preference index, UCM - unresolved complex mixtue, C27/C29 & C29/C31 - relative abundances of long-chain n-alkanes (n-C27-31), %(C29-C31) =SUM(n-C27-n-C31)/SUM(n-C17-nC19+n-C27-nC-31), S/I - relative abundance of porphyrins, VO/(VO+Ni) - relative abundance of vanadyl porphyrins, ACL - everage chain length.

Df fan	type of sed	Sample	TNA, ng/g	CPI 17-23	CPI 24-31	UCM/g, ng/g	UCM/TNA	C27/C29	C29/C31	%(C29-C31)	S/I	VO/(VO+Ni)	ACL25-33
NA north	H1	ODP 609 084	983	1.04	1.59	8227	8.37	1.17	0.99	74.56	6.79	0.91	28.33
NA north	H2	ODP 609 116	1235	1.46	1.41	9913	8.03	1.16	0.95	76.72	14.34	0.9	28.54
NA north	H4	ODP 609 225	6386	1.23	1.8	70408	11.03	1.2	0.89	88.96	7.87	0.92	28.43
NA north	H5	ODP 609 295	3141	1.95	2.36	25620	8.16	1.27	0.83	90.52	8.81	0.81	28.5
NA north	H5	ODP 609 304	1148	1.84	2.22	4535	3.95	0.97	0.97	97.81	13.2	0.81	28.82
NA north	H3	ODP 609 144	4714	0.71	2.35	31811	6.75	0.72	0.84	71.71	6.67	1	29.01
NA north	H3	ODP 609 152	1397	0.61	4.03	3741	2.68	0.63	0.62	99.26	5.4	0	29.7
NA north	H3	ODP 609 159	2033	1.53	3.85	4031	1.98	0.8	0.73	97.87	11.63	0	29.17
NA north	H6	ODP 609 385	1062	0.59	3.04	4654	4.38	0.78	0.62	86.03	30.08	0	29.31
NA north	H6	ODP 609 393	1247	0.76	3.1	6114	4.9	0.91	0.58	96.37	26.77	0.81	29.35
NA north	H6	ODP 609 403	2638	0.49	2.14	20764	7.87	0.88	0.65	84.67	4.63	0	29.08
NA north	H6	ODP 609 415	545	0.84	2.74	1464	2.69	0.7	0.75	91.7	8.53	0.61	29.27
NA north	HP	ODP 609 050		3.44	1.32		2.24	1.25	0.98	100	2.46	0	28.38
NA north	HP	ODP 609 095	1553	1.16	2.38	18903	12.17	0.83	0.8	96.63	3.21	0	29
NA north	HP	ODP 609 137	3967	0.58	2.36	35961	4.36	0.7	0.77	53.34	13.5	1	29.11
NA north	HP	ODP 609 185	830	1.59	4.91	1781	10.99	0.65	1	98.55	15.48	0	29.72
NA north	HP	ODP 609 277	1595	1.12	2.48	20563	2.15	0.8	0.77	86.89	10.07	0	29.01
NA north	HP	ODP 609 350	896	0.71	4.19	3264	10.78	0.93	0.54	94.76	15.29	1	29.34
NA south	HP1	SU90-09-010	601	1.05	1.54	1061	1.77	1.31	0.9	83.04	36.6	0	28.5
NA south	HP1	SU90-09-015	387	1.53	2.51	200	0.52	1.16	0.75	97.06	31	0	28.73
NA south	HP1	SU90-09-020	338	1.09	1.89	200	0.59	0.98	0.73	83.51	40.6	0	29.09
NA south	HP1	SU90-09-025	565	1.23	2.51	200	0.35	1.15	0.78	93.74	118	0	28.68
NA south	HP1	SU90-09-030	2948	0.12	1.88	243	0.08	1.15	0.86	71.01	37.1	0	28.65
NA south	HP1	SU90-09-035	5171	1.17	2.19	9448	1.83	1.49	0.93	56.38	14.7	0	28.34
NA south	HP1	SU90-09-040	1057	1.28	1.93	200	0.19	1.46	0.81	48.39	31	0	28.18
NA south	HP1	SU90-09-045	3982	1.31	1.76	11685	2.93	1.3	0.97	72.29	40.3	0	28.42
NA south	HP1	SU90-09-046	1223	0.67	2.07	8286	6.78	1.17	0.87	65.89	94.9	1	28.59
NA south	HP1	SU90-09-047	1431	1.11	1.75	5046	3.53	1.3	0.85	70.11	42.8	1	28.48
NA south	HP1	SU90-09-048	2248	1.9	1.67	200	0.09	1.2	0.89	83.6	29.2	0	28.6

Appendix3 continued. Biomarker analysis data for hemipelagic (HP), glacigenic debris flow (GDF), glacial till (GT) glacimarine (GM) and Heinrich layer (H) sediments. TNA - total n-alkanes, CPI - carbon preference index, UCM - unresolved complex mixtue, C27/C29 & C29/C31 - relative abundances of long-chain n-alkanes (n-C27-31), %(C29-C31) =SUM(n-C27-n-C31)/SUM(n-C17-nC19+n-C27-nC-31), S/I - relative abundance of porphyrins, VO/(VO+Ni) - relative abundance of vanadyl porphyrins, ACL - everage chain length.

Df fan	type of sed	Sample	TNA, ng/g	CPI 17-23	CPI 24-31	UCM/g, ng/g	UCM/TNA	C27/C29	C29/C31	%(C29-C31)	S/I	VO/(VO+Ni)	ACL25-33
NA south	HP1	SU90-09-049	5533	0.09	1.85	438	0.08	1.11	0.78	70.85	36.8	0	28.81
NA south	H1	SU90-09-050	2544	0.66	1.77	200	0.08	1.18	0.87	90.94	11.7	0	28.66
NA south	H1	SU90-09-050.5	1609	1.44	1.85	16090	10	0.98	0.91	88.63	31.6	0	28.87
NA south	H1	SU90-09-051	5368	1.36	1.79	62940	11.72	1.75	1.04	94.29	21.9	0	28.22
NA south	H1	SU90-09-051.5	2655	1.77	1.22	45946	17.31	1.4	0.95	72.12	72.8	0	28.37
NA south	H1	SU90-09-052	5848	0.27	1.59	20206	3.46	1.34	1	74.81	30.5	0	28.29
NA south	H1	SU90-09-052.5	1582	1.18	1.73	21008	13.28	1.26	0.89	86.24	21.1	0	28.55
NA south	H1	SU90-09-053	1340	1.32	1.65	11586	8.65	1.2	0.92	89.21	38.9	0	28.59
NA south	H1	SU90-09-053.5	1547	1.34	1.6	14738	9.53	1.33	0.92	90.56	43.5	0	28.41
NA south	H1	SU90-09-054	2609	1.63	1.3	12145	4.65	1.32	0.94	94.52	32.7	0	28.64
NA south	H1	SU90-09-054.5	2321	1.91	1.46	34523	14.88	1.4	0.91	67.06	55.3	0	28.4
NA south	H1	SU90-09-055	1332	0.79	1.55	2331	1.75	1.09	0.98	86.85	39.7	0	28.74
NA south	H1	SU90-09-055.5	2709	1.46	1.49	31535	11.64	1.32	1.15	78.75	62.1	0	28.17
NA south	H1	SU90-09-056	1394	1.34	1.45	3511	2.52	1.13	0.87	97.65	25.4	0	28.9
NA south	H1	SU90-09-056.5	1656	1.26	1.67	18594	11.23	1.3	0.91	83.64	44.9	0	28.56
NA south	H1	SU90-09-057	1838	0.94	1.56	16726	9.1	1.32	1.09	90.76	54.1	0	28.3
NA south	H1	SU90-09-057.5	1602	1.34	1.7	21051	13.14	1.47	0.9	80.72	54.7	1	28.37
NA south	H1	SU90-09-058	2451	1.24	1.54	34148	13.93	1.59	1.02	87.06	34	0	28.32
NA south	H1	SU90-09-058.5	2163	1.28	1.78	25935	11.99	1.5	0.91	86.25	46.6	0	28.27
NA south	H1	SU90-09-059	5143	0.82	1.52	74233	14.43	1.47	1	85.24	34.6	0	28.2
NA south	H1	SU90-09-059.5	4281	0.81	1.43	52276	12.21	2.16	2.05	69.4	38.4	1	27.26
NA south	H1	SU90-09-060	2118	1.13	1.59	26584	12.55	1.55	1.06	77.61	58.9	0.7	28.13
NA south	H1	SU90-09-060.5	1810	0.7	1.6	38611	21.34	1.33	0.88	74.19	42.6	1	28.45
NA south	H1	SU90-09-061	3026	0.95	1.71	64321	21.25	2.55	1.19	68.35	67.7	0	27.68
NA south	H1pr	SU90-09-062	1470	1.25	1.94	17617	11.99	1.31	0.84	81.13	63.8	0.88	28.47
NA south	H1pr	SU90-09-063	1366	0.67	2.8	15907	11.64	0.9	0.79	78.61	92.1	1	28.83
NA south	H1pr	SU90-09-064	2717	1	1.69	48973	18.03	1.73	0.85	74.99	58.4	0	28.2
NA south	H1pr	SU90-09-065	1277	1.39	2.51	25863	20.26	1.26	0.75	74.9	160	0	28.66
NA south	H1pr	SU90-09-066	1293	1.03	2.41	24365	18.84	1.08	0.8	73.34	147.7	0	28.76

Appendix3 continued. Biomarker analysis data for hemipelagic (HP), glacigenic debris flow (GDF), glacial till (GT) glacimarine (GM) and Heinrich layer (H) sediments. TNA - total n-alkanes, CPI - carbon preference index, UCM - unresolved complex mixtue, C27/C29 & C29/C31 - relative abundances of long-chain n-alkanes (n-C27-31), %(C29-C31) =SUM(n-C27-n-C31)/SUM(n-C17-nC19+n-C27-nC-31), S/I - relative abundance of porphyrins, VO/(VO+Ni) - relative abundance of vanadyl porphyrins, ACL - everage chain length.

Df fan	type of sed	Sample	TNA, ng/g	CPI 17-23	CPI 24-31	UCM/g, ng/g	UCM/TNA	C27/C29	C29/C31	%(C29-C31)	S/I	VO/(VO+Ni)	ACL25-33
NA south	HP2	SU90-09-067	3691	0.75	2.24	89770	24.32	0.33	0.98	69.93	32.1	0	27.65
NA south	HP2	SU90-09-068	5837	0.99	1.15	73835	12.65	1.85	1.33	77.39	33	0	28.05
NA south	HP2	SU90-09-069	2712	1.3	1.75	61324	22.61	1.09	1.05	63.39	29.5	0	28.34
NA south	HP2	SU90-09-075	3036	1.13	1.87	13307	4.38	1.44	0.92	63.71	39.9	0	28.19
NA south	HP2	SU90-09-077	5022	1	1.67	160447	31.95	1.57	1.57	47.69	37.7	0	27.87
NA south	HP2	SU90-09-078	3230	1.13	1.74	38646	11.97	1.5	0.84	77.12	41	0	28.89
NA south	HP2	SU90-09-080	3295	0.8	1.22	50556	15.34	1.16	2.32	48.2	73.6	1	27.87
NA south	H2	SU90-09-081	4841	0.76	1.58	53957	11.15	1.37	1.09	74.01	38.7	0	28.54
NA south	H2	SU90-09-082	2476	1.16	1.62	43862	17.71	1.23	0.86	60.7	49.4	1	28.58
NA south	H2	SU90-09-084	2523	1.4	1.62	32734	12.98	1.42	0.99	79.67	87.1	0.74	28.21
NA south	H2	SU90-09-086	3128	1.24	1.32	91729	29.33	0.88	1.34	61.35	46.7	0.7	28.17
NA south	H2	SU90-09-086.5	2737	0.85	1.49	35133	12.83	1.64	1.11	74.64	65.8	0.58	28.07
NA south	H2	SU90-09-087	3230	0.93	1.46	13469	4.17	1.52	1.31	72.89	73.2	1	28.07
NA south	H2	SU90-09-087.5	1462	1.08	1.42	49471	33.83	1.45	1.15	84.97	61.2	0.78	28.21
NA south	H2	SU90-09-088	2664	1.13	1.33	32912	12.36	1.44	1.17	80.36	60.8	1	28.26
NA south	H2	SU90-09-088.5	2198	1.18	1.39	31672	14.41	1.67	1.19	69.29	67.3	0.71	28.06
NA south	H2	SU90-09-089	2470	1.34	1.78	32418	13.13	1.33	1.13	68.35	51.6	0.66	28.3
NA south	H2	SU90-09-089.5	1718	1.09	1.43	20245	11.78	1.48	1.27	73.64	81.8	0.84	27.98
NA south	H2	SU90-09-090.5	4884	1.07	1.36	47889	9.81	1.56	1.23	75.54	92.3	0.9	28.14
NA south	H2	SU90-09-091	7111	1.59	1.28	149654	21.05	1.38	1.03	39.15	74	0.83	28.22
NA south	H2	SU90-09-091.5	4437	1.78	1.97	79448	17.9	1.59	0.92	39.02	39.4	0	28.14
NA south	H2	SU90-09-092	4096	1.65	1.84	86309	21.07	1.12	1	28.13	53.8	1	28.18
NA south	H2pr	SU90-09-093	1754	0.65	1.94	22043	12.57	1.25	0.87	89.49	50	0	28.49
NA south	H2pr	SU90-09-094	2078	0.91	2.88	33578	16.16	1.2	0.79	82.71	48.2	1	28.65
NA south	H2pr	SU90-09-095	3698	1.3	1.76	59153	16	1.34	0.86	65.31	51.5	0	28.45
NA south	H2pr	SU90-09-096	5949	0.88	1.44	124413	20.91	1.37	1.08	79.35	32.1	0	28.32
NA south	H2pr	SU90-09-097	7020	1.04	1.31	89222	12.71	1.49	0.9	80.82	35.2	0	28.5
NA south	HP3	SU90-09-098	7989	0.86	1.45	135990	17.02	1.32	1.03	75.5	41.6	0	28.23
NA south	HP3	SU90-09-099	5492	1	1.36	78286	14.26	1.37	0.87	80.22	64.5	0	28.39

Appendix3 continued. Biomarker analysis data for hemipelagic (HP), glacigenic debris flow (GDF), glacial till (GT) glacimarine (GM) and Heinrich layer (H) sediments. TNA - total n-alkanes, CPI - carbon preference index, UCM - unresolved complex mixtue, C27/C29 & C29/C31 - relative abundances of long-chain n-alkanes (n-C27-31), %(C29-C31) =SUM(n-C27-n-C31)/SUM(n-C17-nC19+n-C27-nC-31), S/I - relative abundance of porphyrins, VO/(VO+Ni) - relative abundance of vanadyl porphyrins, ACL - everage chain length.

Df fan	type of sed	Sample	TNA, ng/g	CPI 17-23	CPI 24-31	UCM/g, ng/g	UCM/TNA	C27/C29	C29/C31	%(C29-C31)	S/I	VO/(VO+Ni)	ACL25-33
NA south	HP3	SU90-09-102	6566	1.27	1.48	104345	15.89	1.33	0.84	72.35	42.3	0	28.29
NA south	HP3	SU90-09-103	4599	0.89	1.62	63294	13.76	1.04	0.99	76.13	43.5	0	28.62
NA south	HP3	SU90-09-104	3615	0.95	2.47	61367	16.98	0.87	0.84	64.79	40.4	0	28.89
NA south	HP3	SU90-09-105	4898	0.91	1.87	77845	15.89	1.13	0.85	67.55	50.8	0	28.59
NA south	HP3	SU90-09-106	7737	0.86	1.92	204984	26.49	0.98	1.96	39.22	47.1	0	27.48
NA south	H3	SU90-09-109	5550	1.71	2.25	92427	16.65	0.97	0.8	74.21	14.3	0	28.96
NA south	H3	SU90-09-110	3775	0.99	2.26	60839	16.12	0.94	0.9	79.49	39.2	0	28.85
NA south	H3	SU90-09-111	7852	1.23	2.02	132945	16.93	1.37	1.04	69.44	48.6	0	28.49
NA south	H3	SU90-09-112	6049	0.9	2.35	126238	20.87	1.24	1.03	72.41	48.6	1	28.3
NA south	H3	SU90-09-113	5175	1.03	2.53	85221	16.47	1	1.06	74.67	59.9	0	28.5
NA south	HP4	SU90-09-116	7114	1.45	2.08	129791	18.24	0.96	1.22	58.53	66.4	0	28.47
NA south	HP4	SU90-09-117	1842	1.43	3.97	12498	6.79	0.88	0.64	94.35	37.7	0	29.12
NA south	HP4	SU90-09-120	2139	2.26	3.69	200	0.09	0.92	0.68	96.69	46.6	0	28.98
NA south	HP4	SU90-09-125	1088	1.36	4.22	200	0.18	0.69	0.64	98.06	70.1	1	29.37
NA south	HP4	SU90-09-130	2273	1.09	3.77	9925	4.37	0.97	0.73	67.97	73.9	1	28.82
NA south	HP4	SU90-09-135	1728	1.41	3.11	200	0.12	1	0.79	93.13	92.3	1	28.72
NA south	HP4	SU90-09-140	1409	1.33	2.73	200	0.14	0.93	0.85	94.93	105	0.94	28.72
NA south	HP4	SU90-09-141	1972	1.29	1.98	14598	7.4	1.26	0.95	89.72	110.8	1	28.45
NA south	HP4	SU90-09-142	1999	1.28	2.39	15737	7.87	1.12	0.89	82.77	111.5	1	28.51
NA south	HP4	SU90-09-143	1714	1.29	2.47	13859	8.09	0.88	0.9	87.43	162.7	1	28.74
NA south	H4	SU90-09-144	1684	1.29	2.47	13473	8	1.22	0.91	86.23	115.6	0.86	28.45
NA south	H4	SU90-09-144.5	2138	1.32	2.04	21280	9.95	1.13	1.05	83.23	104.9	1	28.35
NA south	H4	SU90-09-145	1412	1.45	2.26	15601	11.05	1.08	1	86.19	106.3	1	28.52
NA south	H4	SU90-09-145.5	2383	1.36	1.8	20399	8.56	1.16	0.98	87.4	87.3	1	28.54
NA south	H4	SU90-09-146	1460	1.35	2.09	13584	9.31	1.08	1.06	91.76	92.8	1	28.4
NA south	H4	SU90-09-146.5	1704	1.6	2.02	20556	12.06	1.13	1.15	86.96	94.4	1	28.37
NA south	H4	SU90-09-147	1662	1.38	1.98	15618	9.4	1.16	1.17	86.42	96.6	1	28.3
NA south	H4	SU90-09-147.5	1582	1.33	2.02	20948	13.24	1.29	1.2	73.88	172.1	0.88	28.12
NA south	H4	SU90-09-148	1585	1.39	1.81	21038	13.27	1.44	1.12	67.96	171.9	0.89	28.17
NA south	H4	SU90-09-148.5	2969	1.32	1.41	21638	7.29	1.3	1.16	86.15	104.5	0.89	28.36
NA south	H4	SU90-09-150	3282	1.27	1.22	10753	3.28	1.33	1.12	94.3	92.1	0	28.48

Appendix3 continued. Biomarker analysis data for hemipelagic (HP), glacigenic debris flow (GDF), glacial till (GT) glacimarine (GM) and Heinrich layer (H) sediments. TNA - total n-alkanes, CPI - carbon preference index, UCM - unresolved complex mixtue, C27/C29 & C29/C31 - relative abundances of long-chain n-alkanes (n-C27-31), %(C29-C31) =SUM(n-C27-n-C31)/SUM(n-C17-nC19+n-C27-nC-31), S/I - relative abundance of porphyrins, VO/(VO+Ni) - relative abundance of vanadyl porphyrins, ACL - everage chain length.

Df fan	type of sed	Sample	TNA, ng/g	CPI 17-23	CPI 24-31	UCM/g, ng/g	UCM/TNA	C27/C29	C29/C31	%(C29-C31)	S/I	VO/(VO+Ni)	ACL25-33
NA south	H4	SU90-09-150.5	1993	1.47	1.95	24094	12.09	1.27	1.21	80.89	115.3	0.8	28.22
NA south	H4	SU90-09-151	2054	1.37	1.61	20680	10.07	1.29	1.25	97.35	165.1	0.82	28.13
NA south	H4	SU90-09-151.5	2086	1.31	1.98	23111	11.08	1.2	1.34	78.69	121.9	0.81	28.08
NA south	H4	SU90-09-152	1827	1.36	1.93	19701	10.78	1.13	1.22	79.67	114.7	0.94	28.29
NA south	H4	SU90-09-152.5	2482	1.57	2.28	30026	12.1	1.22	1.17	74.53	135	0.95	28.17
NA south	H4	SU90-09-153	1770	1.52	2.92	17765	10.03	1.11	0.87	83.78	71.5	0.94	28.63
NA south	HP5	SU90-09-153.5	1342	1.41	3.26	14292	10.65	1.02	0.77	87.18	43.2	1	28.83
NA south	HP5	SU90-09-154	1353	1.4	3.35	7869	5.81	0.95	0.72	93.82	49.8	1	28.94
NA south	HP5	SU90-09-155	1881	1.53	3.33	200	0.11	1.01	0.76	93.92	50.4	1	28.81
NA south	HP5	SU90-09-156	2649	1.52	2.03	8190	3.09	1.26	0.84	77.88	56.9	0	28.7
NA south	HP5	SU90-09-160	1289	1.26	3.56	1456	1.13	0.95	0.72	90.43	20.2	1	28.9
NA south	HP5	SU90-09-165	1452	1.66	3.67	200	0.14	1.02	0.73	96.35	28	1	28.83
NA south	HP5	SU90-09-170	2532	1.38	3.41	5548	2.19	1.24	0.82	86.49	51.5	0	28.41
NA south	HP5	SU90-09-175	2068	1.45	3.32	200	0.1	1.15	0.82	93.36	42.5	1	28.55
NA south	HP5	SU90-09-180	1815	1.28	2.92	1715	0.94	1.13	0.84	89.82	38.5	1	28.59
NA south	HP5	SU90-09-185	1034	1.58	2.68	200	0.19	0.99	0.82	88.54	35.4	1	28.82
NA south	HP5	SU90-09-186	431	1.31	2.86	3040	7.06	1.02	0.82	82.1	62.7	1	28.73
NA south	H5	SU90-09-187	1323	1.4	3.01	15618	11.8	1.2	0.89	73	98	1	28.51
NA south	H5	SU90-09-187.5	1916	1.65	2.34	28173	14.7	1.32	0.98	77.1	88.7	0.72	28.25
NA south	H5	SU90-09-188	1340	1.58	2.99	16492	12.31	1.2	0.87	72.93	45.2	1	28.45
NA south	H5	SU90-09-188.5	1461	1.54	3.1	16109	11.02	1.17	0.92	77.57	100.9	1	28.45
NA south	H5	SU90-09-189	2297	1.78	2.7	30566	13.31	1.23	0.98	76.33	85.6	0.09	28.46
NA south	H5	SU90-09-189.5	3770	1.35	1.9	33803	8.97	1.52	1.43	47.81	159.8	1	27.77
NA south	H5	SU90-09-190	2263	1.43	1.79	13845	6.12	1.24	0.99	80.6	89	1	28.43
NA south	H5	SU90-09-190.5	2412	1.58	1.92	20623	8.55	1.25	1.03	60.94	103.4	1	28.38
NA south	H5	SU90-09-191	1558	1.43	2.99	15751	10.11	0.99	0.99	78.4	118.5	1	28.48
NA south	H5	SU90-09-191.5	2155	1.45	2.75	16729	7.76	1.22	1.09	81.05	114.8	0.89	28.19
NA south	H5	SU90-09-192	1480	1.64	2.9	15677	10.59	1.17	1.1	74.86	117.6	1	28.26
NA south	H5	SU90-09-192.5	1763	1.52	2.35	27854	15.8	1.25	1.2	66.37	158.9	0.92	28.14
NA south	H5	SU90-09-193	1808	1.38	2.94	21563	11.92	1.12	0.94	79.7	119	1	28.45
NA south	HP6	SU90-09-193.5	1558	1.09	3.12	22915	14.71	1.25	0.99	69.51	137.1	1	28.3