

Table S1: Locations, the total number of cores collected across marsh zones (total depth in brackets), and the surrounding vegetation types for each study site.

Marsh Zone	Core	Location (WGS84)	Dominant Vegetation
Pāuatahanui Wildlife Reserve			
Low marsh	Pau-LM1 (18 cm)	-41.0996522, 174.9150162	<i>Juncus kraussii</i> with sparse <i>Kindberdia</i> spp. and <i>Polytrichum</i> spp.
	Pau-LM2 (30 cm)	-41.0983717, 174.9138370	
	Pau-LM3 (15 cm)	-41.1006246, 174.9138819	
	Pau-LM4 (28 cm)	-41.1035482, 174.9114934	
Mid marsh	Pau-MM1 (20 cm)	-41.0991782, 174.9157722	<i>Apodasmia similis</i> , <i>Plagianthus divaricatus</i> , <i>Typha orientalis</i> , <i>Lolium arundinaceum</i> , sparse <i>Kindberdia</i> spp. and <i>Polytrichum</i> spp.
	Pau-MM2 (16 cm)	-41.0973502, 174.9145763	
	Pau-MM3 (15 cm)	-41.1022903, 174.9146370	
	Pau-MM4 (44 cm)	-41.1039568, 174.9087110	
High marsh	Pau-HM1 (24 cm)	-41.0992224, 174.9170620	<i>Plagianthus divaricatus</i> , <i>Poa annua</i> , <i>Selliera radicans</i> , <i>Carex flagellifera</i> , <i>Lolium arundinaceum</i> , <i>Carex coriacea</i> , <i>Typha orientalis</i> , <i>Phormium tenax</i>
	Pau-HM2 (20 cm)	-41.0974905, 174.9166265	
	Pau-HM3 (16 cm)	-41.1021537, 174.9157384	
	Pau-HM4 (27 cm)	-41.1059960, 174.9133733	
Robert Findlay Wildlife Reserve			
Low marsh	Puk-LM1 (5 cm)	-37.1829576, 175.3222302	<i>Samolus repens</i> and <i>Salicornia quinqueflora</i>
	Puk-LM2 (10 cm)	-37.1822626, 175.3221232	
	Puk-LM3 (5 cm)	-37.1793629, 175.3222583	
Mid marsh	Puk-MM1 (12 cm)	-37.1764619, 175.3204250	<i>Carex divisa</i> , <i>Selliera radicans</i> , <i>Isolepis cernua</i>
	Puk-MM2 (12 cm)	-37.1795753, 175.3227817	
	Puk-MM3 (10 cm)	-37.1822105, 175.3214345	
High marsh	Puk-HM1 (5 cm)	-37.1755747, 175.3205353	<i>Bromus catharticus</i> , <i>Polypogon viridis</i> , <i>Epilobium ciliatum</i> , <i>Carex divisa</i>
	Puk-HM2 (10 cm)	-37.1799204, 175.3229108	
	Puk-HM3 (10 cm)	-37.1824418, 175.3212890	
Omaia Island			
Low marsh	Oma-LM1 (20 cm)	-34.9844134, 173.2648659	<i>Pasture</i> , <i>Cotula coronopifolia</i> , <i>Lagurus ovatus</i> , <i>Polypogon monspeliensis</i> and <i>Lobelia anceps</i>
	Oma-LM2 (34 cm)	-34.9960895, 173.2589576	
	Oma-LM3 (30 cm)	-35.0009796, 173.2692111	
Mid marsh	Oma-MM1 (20 cm)	-34.9890245, 173.2640991	
	Oma-MM2 (14 cm)	-34.9900862, 173.2639586	
	Oma-MM3 (20 cm)	-34.9976081, 173.2615339	
High marsh	Oma-HM1 (29.5 cm)	-34.9951711, 173.2631915	
	Oma-HM2 (20 cm)	-34.9953268, 173.2623952	
	Oma-HM3 (22 cm)	-34.9980382, 173.2661889	
Okatakata Islands			
Low marsh	Oka-LM1 (47 cm)	-34.9920759, 173.2734023	<i>Juncus kraussii</i> , <i>Salicornia quinqueflora</i> , sparse <i>Kindberdia</i> spp. and <i>Polytrichum</i> spp.
	Oka-LM2 (30 cm)	-34.9879439, 173.2758958	
	Oka-LM3 (30 cm)	-34.9840782, 173.2801531	
Mid marsh	Oka-MM1 (30 cm)	-34.9830517, 173.2799168	<i>Apodasmia similis</i> , <i>Machaerina juncea</i> , sparse <i>Kindberdia</i> spp. and <i>Polytrichum</i> spp.
	Oka-MM2 (20 cm)	-34.9874470, 173.2751894	
	Oka-MM3 (30 cm)	-34.9918548, 173.2737624	
High marsh	Oka-HM1 (15 cm)	-34.9827858, 173.2796975	<i>Cyperus ustulatus</i> , <i>Ficinia nodosa</i> , <i>Austroderia splendens</i> , <i>Cortaderia jubata</i>
	Oka-HM2 (20 cm)	-34.9859390, 173.2754546	
	Oka-HM3 (20 cm)	-34.9912065, 173.2742546	
Awanui			
Low marsh	Awa-LM1 (6 cm)	-35.0049151, 173.2670039	<i>Salicornia quinqueflora</i> and <i>Juncus kraussii</i>
	Awa-LM2 (5 cm)	-35.0049596, 173.2663042	
	Awa-LM3 (30 cm)	-35.0050615, 173.2642325	
Mid marsh	Awa-MM1 (40 cm)	-35.0052644, 173.2634138	<i>Apodasmia similis</i> , <i>Machaerina juncea</i> , sparse <i>Kindberdia</i> spp. and <i>Polytrichum</i> spp.
	Awa-MM2 (95 cm)	-35.0106002, 173.2612322	
	Awa-MM3 (45 cm)	-35.0103981, 173.2614833	

Core Pau-HM3

Coordinates: -41.1021537, 174.9157834

Author: O. Albot

Depth (cm)	Photo	Illustration	Description and components	Nig	Strf	Sicc	Elas	Lim
0			Dark brown, rooty, clayey peat Sh2 Th1As1Ag+	3	0	3	1	
2								
4								
6								
8								
10								
12			Dark brown, organic-rich silt with fine sand component Ag3, Ga1	3	0	3	2	0
14								
16								
18			Light greyish brown, sub-rounded medium sand Ga4	1	0	3	3	1
20								
22								
24								
26								
28								
30								
32								
34								
36								
38								
40								
42								

MB(C)

Overlying vegetation: 100% *Lolium arundinaceum*

Figure S1: Detailed stratigraphic log for core Pau-HM3 from Pāuatahanui following the Troels-Smith (1955) sediment classification system. MB (C) – marsh base via correlation with other cores.

Core Puk-MM1

Coordinates: -37.1764619, 175.3204250

Author: O. Albot

Depth (cm)	Photo	Illustration	Description and components	Nig	Strf	Sicc	Elas	Lim
0			Woody, TI-dominated peat TI2 Sh1 Th1 Dh++ DI+ Dg+	3.5	0	2	3	
2								
4			Gradual transition to underlying unit					
6			Brown, organic-rich silty clay. Ag to As (downwards transition), with common shell fragments and root/plant material	3	0	2	3	0
8								
10			Ag2 As2 Th++ Dh+ DI+ Dg+					
12			Gradual transition to underlying unit					
14			Grey clay with shell and plant material As4 Dg++ Dh+ Di+ Th+	2	0	2	0.5	0
16			As above but with minor sand and silt component As3 Ga1 Ag1 Dg++ Dh+ Di+ Th+	2	0	2	0.5	0
18								
20								

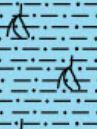
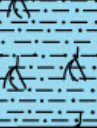
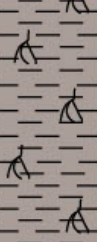
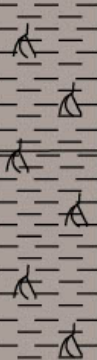
Overlying vegetation: 98% *Carex divisa*, 2% *Salicornia quinqueflora*. Trace: *Lolium arundinaceum*, *Foeniculum vulgare*, *Polypogon viridis*
Base of marsh based on correlation with Puk-LM3 & HM2.

Figure S2: Detailed stratigraphic log for core Puk-MM1 from Robert Findlay following the Troels-Smith (1955) sediment classification system. MB(C) = marsh base via correlation with other cores.

Core Oma-MM3

Coordinates: -34.9976081, 173.2615339

Author: D.J. King & O. Albot

Depth (cm)	Photo	Illustration	Description and components	Nig	Strf	Sicc	Elas	Lim
0			Medium to dark brown silt with <i>Lolium perenne</i> fragments and leaves of assorted plants. Ag2 Th1 Dh1 Ga++ Sh+	2	0	4	2	
5			Dark brown fine sandy silt with roots Ag2 Ga1 As1 Th+ Dg+	3	1	2	1	1
10			Slightly greenish medium brown clay with roots As3 Ga1 Th++ Ag+ Sh+ Dh+	2	1	3	1	1
15								
20			Chocolate brown silty clay with roots As1 Ag1 Th1 Ga1	2	0	2	0	1
25								

— SF

— MB
— NF

Overlying vegetation: See Table S4.1.

Duplicates of this core extend to 46 cm depth, getting sandier below 36.5 cm. Absence of foraminifera below ~20 cm indicates a potentially terrestrial (non-salt marsh) soil underlying the marsh in this core.

Figure S3: Detailed stratigraphic log for core Oma-MM3 from Omaia following the Troels-Smith (1955) sediment classification system. SF = saltmarsh foraminifera; MB = marsh base; NF = no foraminifera.

Core Oka-MM1

Coordinates: -34.9830517, 173.2799168

Author: O. Albot

Depth (cm)	Photo	Illustration	Description and components	Nig	Strf	Sicc	Elas	Lim
0			Black peat with minor dark greyish brown clayey silts, Dh fragments at 4 cm, from 8-10 cm increase to greyish brown organic-rich clayey silt Dh1 Dl1 Th1 Ag1 As++	4	0	3	1/2	
10			Dark grey organic-rich silty clay As2 Ag1 Sh1 Th+	4	0	2.5	1	2
			Brownish grey, organic-rich silty clay Dg As1 Ag1 Dh1 Dg1 Th+ Sh+	3	0	2.5	1	
20			Grey silty clay As2 Ag2 Dh++ Dl+ Th+	3	0	2.5	1	
			Dark brown silty clay with As2 Ag2 Dh++ Dg++ Dl+ Th+	3	0	2.5	0.5	
30								
40								
50								

MB

Overlying vegetation: 50% *Machaerina juncea*, 50% *Apodasmia similis*. Trace: *Austroderia splendens*. Based on Oka-MM2, this core represents salt marsh all the way down to the base.

Figure S4: Detailed stratigraphic log for core Oka-MM1 from Okatakata following the Troels-Smith (1955) sediment classification system. MB = marsh base.

Core Awa-MM2

Coordinates: - 35.0106002, 173.2612322

Author: O. Albot & D.J. King

Depth (cm)	Photo	Illustration	Description and components	Nig	Strf	Sicc	Elas	Lim	
0			Dark chocolate brown rooty, silty peat Sh2 Th1 Ag1	3.5	1	2	2		SF
10			Pale orangeish beige rooty clay Ag2 Th1 Sh1	2	0	2	0	3	
20			Dark blue-grey densely rooty clay Th3 As1	3.5 to 4	0	2	0	3	
30			Medium brown, rooty, organic-rich clay As2 Th1 Sh1	3	0	2	0	2	
40			Down-core transition to peat						
50			Dark, chocolate brown, subtly fibrous peat Sh3 Th1 TH+ As+	3.5	0	2	1.5	1	SF
60									
70									
80									
90									SF
100									

Overlying vegetation: 100% *Apodasmia similis*

On the basis of foraminifera (and sedimentology), this core is saltmarsh all the way to the base, and the underlying mud/sandflat was not reached

Figure S5: Detailed stratigraphic log for core Awa-MM2 from Awanui following the Troels-Smith (1955) sediment classification system. SF = saltmarsh foraminifera.

Table S2: The results of Levene's, Shapiro-Wilk's and Kruskal-Wallis tests for Total Organic Carbon (TOC; wt%), Total Nitrogen (TN; wt%), Carbon Density (CD; g cm⁻³), and Dry Bulk Density (DBD; g cm⁻³). Oka – Okatakata; Awa – Awanui; Oma – Omaia; Pau – Pāuatahanui; Puk – Robert Findlay.

Variable	Levene's p-Value Across Sites	Shapiro-Wilk's p-Value By Site	Kruskal-Wallis p-Value Across Sites	Kruskal-Wallis p-Value By Vegetation Zone
TOC (wt%)	1.31E-05	Pau: 3.96E-05 Puk: 4.16E-02 Oma: 1.30E-09 Oka: 6.79E-14 Awa: 4.57E-07	4.47E-16	Pau: 0.0262 Puk: 0.6472 Oma: 0.0019 Oka: 0.0002 Awa: 0.0027
TN (wt%)	2.00E-04	Pau: 4.42E-04 Puk: 1.50E-01 Oma: 1.16E-10 Oka: 6.55E-12 Awa: 1.28E-03	1.13E-15	Pau: 0.0048 Puk: 0.2373 Oma: 0.0005 Oka: 2.6E-05 Awa: 0.0412
CD (g cm⁻³)	5.13E-07	Pau: 2.37E-07 Puk: 7.94E-03 Oma: 1.13E-08 Oka: 1.47E-13 Awa: 5.43E-08	4.23E-09	Pau: 0.1032 Puk: 0.8825 Oma: 0.0406 Oka: 0.1247 Awa: 0.0014
DBD (g cm⁻³)	5.03E-05	Pau: 0.1110 Puk: 0.0880 Oma: 0.0120 Oka: 0.0754 Awa: 0.0003	0.0006926	Pau: 5.9e-05 Puk: 0.3361 Oma: 0.0076 Oka: 9.5e-05 Awa: 0.0222

Table S3: The results of the post-hoc Dunn tests for all sites: Oka – Okatakata; Awa – Awanui; Oma – Omaia; Pau – Pāuatahanui; Puk – Robert Findlay. The final p-value was obtained by applying the Benjamini-Hochberg correction.

Total Organic Carbon (wt%)				
	Oka	Oma	Pau	Puk
Awa	1.45E-02	2.83E-06	8.04E-02	1.28E-02
Oka	-	1.16E-02	2.94E-06	6.56E-06
Oma	-	-	1.16E-12	4.44E-10
Pau	-	-	-	1.45E-01
Total Nitrogen (wt%)				
	Oka	Oma	Pau	Puk
Awa	0.5654	0.0032	0.0016	9.1E-06
Oka	-	0.0089	3.96E-05	4.73E-07
Oma	-	-	3.56E-11	1.52E-11
Pau	-	-	-	0.0141
Carbon Density (g cm ⁻³)				
	Oka	Oma	Pau	Puk
Awa	0.0364	0.0006	0.4746	0.0149
Oka	-	0.0944	0.0020	0.0000
Oma	-	-	0.0000	0.0000
Pau	-	-	-	0.0334
Dry Bulk Density (g cm ⁻³)				
	Oka	Oma	Pau	Puk
Awa	0.9291	0.3071	0.0567	0.8732
Oka	-	0.3859	0.0144	0.9741
Oma	-	-	0.0005	0.5750
Pau	-	-	-	0.0945

Table S4: The results of the post-hoc Dunn tests for Pāuatahanui. The final p-value was obtained by applying the Benjamini-Hochberg correction.

Total Organic Carbon (wt%)								
	Pau-LM1	Pau-LM2	Pau-LM3	Pau-LM4	Pau-MM1	Pau-MM2	Pau-MM3	Pau-MM4
Pau-HM1	0.047	0.053	0.933	0.671	0.143	0.055	0.040	0.088
Pau-HM2	0.047	0.049	0.702	0.418	0.108	0.059	0.029	0.089
Pau-HM3	0.709	0.932	0.107	0.047	0.681	0.686	0.574	0.202
Pau-HM4	0.095	0.090	0.933	0.717	0.204	0.106	0.050	0.195
Pau-LM1	-	-	-	-	0.918	0.925	0.331	0.496
Pau-LM2	-	-	-	-	0.749	0.770	0.528	0.384
Pau-LM3	-	-	-	-	0.337	0.218	0.063	0.380
Pau-LM4	-	-	-	-	0.274	0.109	0.046	0.202
Total Nitrogen (wt%)								
	Pau-LM1	Pau-LM2	Pau-LM3	Pau-LM4	Pau-MM1	Pau-MM2	Pau-MM3	Pau-MM4
Pau-HM1	0.174	0.098	0.774	0.972	0.264	0.060	0.030	0.058
Pau-HM2	0.104	0.059	0.901	0.590	0.150	0.055	0.050	0.057
Pau-HM3	0.338	0.770	0.055	0.091	0.542	0.743	0.622	0.354
Pau-HM4	0.195	0.109	0.867	0.869	0.265	0.099	0.042	0.106
Pau-LM1	-	-	-	-	0.957	0.692	0.184	0.889
Pau-LM2	-	-	-	-	0.758	0.944	0.452	0.781
Pau-LM3	-	-	-	-	0.240	0.103	0.044	0.115
Pau-LM4	-	-	-	-	0.253	0.054	0.029	0.054
Carbon Density (g cm ⁻³)								
	Pau-LM1	Pau-LM2	Pau-LM3	Pau-LM4	Pau-MM1	Pau-MM2	Pau-MM3	Pau-MM4
Pau-HM1	0.024	0.810	0.937	0.210	0.815	0.442	0.472	0.105
Pau-HM2	0.0155	0.487	0.728	0.129	0.491	0.22	0.26	0.097
Pau-HM3	0.923	0.128	0.126	0.217	0.179	0.216	0.484	0.316
Pau-HM4	0.0144	0.663	0.878	0.206	0.662	0.359	0.408	0.124
Pau-LM1	-	-	-	-	0.138	0.159	0.441	0.212
Pau-LM2	-	-	-	-	0.942	0.723	0.677	0.402
Pau-LM3	-	-	-	-	0.801	0.568	0.546	0.322
Pau-LM4	-	-	-	-	0.652	0.814	0.987	0.808
Dry Bulk Density (g cm ⁻³)								
	Pau-LM1	Pau-LM2	Pau-LM3	Pau-LM4	Pau-MM1	Pau-MM2	Pau-MM3	Pau-MM4
Pau-HM1	0.032	0.110	0.853	0.002	0.138	0.149	0.112	0.530
Pau-HM2	0.189	0.121	0.988	0.086	0.142	0.164	0.116	0.930
Pau-HM3	0.204	0.033	0.825	0.070	0.045	0.042	0.037	0.839
Pau-HM4	0.072	0.191	0.825	0.020	0.219	0.289	0.167	0.605
Pau-LM1	-	-	-	-	0.002	0.000	0.001	0.072
Pau-LM2	-	-	-	-	1.000	0.824	0.812	0.029
Pau-LM3	-	-	-	-	0.165	0.203	0.135	0.943
Pau-LM4	-	-	-	-	0.000	0.000	0.000	0.005

Table S5: The results of the post-hoc Dunn tests for Okatakata. The final p-value was obtained by applying the Benjamini-Hochberg correction.

Total Organic Carbon (wt%)						
	Oka-LM1	Oka-LM2	Oka-LM3	Oka-MM1	Oka-MM2	Oka-MM3
Oka-HM1	0.077	0.032	0.084	0.103	0.900	0.743
Oka-HM2	0.102	0.044	0.124	0.198	0.519	0.692
Oka-HM3	0.033	0.016	0.044	0.036	0.671	0.515
Oka-LM1	-	-	-	0.802	0.075	0.084
Oka-LM2	-	-	-	0.222	0.035	0.031
Oka-LM3	-	-	-	0.636	0.080	0.091
Total Nitrogen (wt%)						
	Oka-LM1	Oka-LM2	Oka-LM3	Oka-MM1	Oka-MM2	Oka-MM3
Oka-HM1	0.103	0.019	0.098	0.123	0.871	0.857
Oka-HM2	0.035	0.005	0.080	0.083	1.000	0.993
Oka-HM3	0.036	0.008	0.047	0.057	0.672	0.696
Oka-LM1	-	-	-	0.844	0.133	0.109
Oka-LM2	-	-	-	0.103	0.023	0.019
Oka-LM3	-	-	-	0.681	0.128	0.103
Carbon Density (g cm ⁻³)						
	Oka-LM1	Oka-LM2	Oka-LM3	Oka-MM1	Oka-MM2	Oka-MM3
Oka-HM1	0.327	0.004	0.007	0.155	0.399	0.359
Oka-HM2	0.403	0.047	0.074	0.934	0.683	0.688
Oka-HM3	0.189	0.003	0.004	0.073	0.318	0.270
Oka-LM1	-	-	-	0.468	0.958	0.955
Oka-LM2	-	-	-	0.027	0.040	0.036
Oka-LM3	-	-	-	0.046	0.053	0.048
Dry Bulk Density (g cm ⁻³)						
	Oka-LM1	Oka-LM2	Oka-LM3	Oka-MM1	Oka-MM2	Oka-MM3
Oka-HM1	0.071	0.912	0.908	0.705	0.890	1.000
Oka-HM2	0.000	1.000	1.000	0.053	1.000	0.993
Oka-HM3	0.001	1.000	0.995	0.067	1.000	1.000
Oka-LM1	-	-	-	0.074	0.001	0.001
Oka-LM2	-	-	-	0.063	0.999	1.000
Oka-LM3	-	-	-	0.067	0.993	1.000

Table S6: The results of the post-hoc Dunn tests for Omaia. The final p-value was obtained by applying the Benjamini-Hochberg correction.

Total Organic Carbon (wt%)						
	Oma-LM1	Oma-LM2	Oma-LM3	Oma-MM1	Oma-MM2	Oma-MM3
Oma-HM1	1.000	0.011	0.517	0.997	0.738	0.992
Oma-HM2	0.390	0.457	0.802	0.410	0.561	0.444
Oma-HM3	0.005	0.474	0.032	0.005	0.004	0.005
Oma-LM1	-	-	-	1.000	0.697	0.996
Oma-LM2	-	-	-	0.019	0.023	0.023
Oma-LM3	-	-	-	0.537	0.773	0.557
Total Nitrogen (wt%)						
	Oma-LM1	Oma-LM2	Oma-LM3	Oma-MM1	Oma-MM2	Oma-MM3
Oma-HM1	0.960	0.182	0.185	0.974	0.976	0.980
Oma-HM2	0.204	0.937	1.000	0.189	0.176	0.176
Oma-HM3	0.001	0.019	0.186	0.003	0.002	0.003
Oma-LM1	-	-	-	0.969	0.843	0.964
Oma-LM2	-	-	-	0.181	0.169	0.190
Oma-LM3	-	-	-	0.173	0.194	0.176
CD (g cm ⁻³)						
	Oma-LM1	Oma-LM2	Oma-LM3	Oma-MM1	Oma-MM2	Oma-MM3
Oma-HM1	0.929	0.033	0.088	0.939	0.067	0.843
Oma-HM2	0.213	0.600	0.834	0.225	0.771	0.451
Oma-HM3	0.000	0.043	0.078	0.000	0.069	0.002
Oma-LM1	-	-	-	0.984	0.065	0.813
Oma-LM2	-	-	-	0.034	0.959	0.080
Oma-LM3	-	-	-	0.093	0.967	0.222
DBD (g cm ⁻³)						
	Oma-LM1	Oma-LM2	Oma-LM3	Oma-MM1	Oma-MM2	Oma-MM3
Oma-HM1	0.776	0.754	0.117	0.766	0.002	0.504
Oma-HM2	0.372	0.581	0.530	0.384	0.057	0.984
Oma-HM3	0.001	0.000	0.392	0.001	0.734	0.073
Oma-LM1	-	-	-	0.996	0.001	0.367
Oma-LM2	-	-	-	0.513	0.000	0.580
Oma-LM3	-	-	-	0.069	0.274	0.536

Table S7: The results of the post-hoc Dunn tests for Awanui. The final p-value was obtained by applying the Benjamini-Hochberg correction.

Total Organic Carbon (wt%)			
	Awa-MM1	Awa-MM2	Awa-MM3
Awa-LM1	0.526	0.009	0.241
Awa-LM2	0.572	0.115	0.425
Awa-LM3	0.512	0.198	0.934
Total Nitrogen (wt%)			
	Awa-MM1	Awa-MM2	Awa-MM3
Awa-LM1	0.533	0.019	0.209
Awa-LM2	0.579	0.141	0.397
Awa-LM3	0.180	0.579	0.470
Carbon Density (g cm ⁻³)			
	Awa-MM1	Awa-MM2	Awa-MM3
Awa-LM1	0.924	0.014	0.909
Awa-LM2	1.000	0.070	1.000
Awa-LM3	1.000	0.011	0.841
Dry Bulk Density (g cm ⁻³)			
	Awa-MM1	Awa-MM2	Awa-MM3
Awa-LM1	0.483	0.224	0.614
Awa-LM2	0.887	0.522	0.808
Awa-LM3	0.699	0.008	0.815

Table S8: Mean ($\pm$ standard error) values for Total Organic Carbon (TOC; wt%), Total Nitrogen (TN; wt%), Dry Bulk Density (DBD; g cm⁻³), Carbon Density (CD; g cm⁻³), and carbon stocks (Mg C ha⁻¹) for all study sites. The carbon stocks were calculated to the top 10 cm (standardised where required) and the total length of the marsh deposits at all sites.

Site	TOC (%, mean $\pm$ SE)	TN (%, mean $\pm$ SE)	DBD (g cm ⁻³ , mean $\pm$ SE)	CD (g cm ⁻³ , mean $\pm$ SE)	Carbon Stock (Mg C ha ⁻¹ ; standardised to 10 cm $\pm$ SE)	Carbon Stock (Mg C ha ⁻¹ ; mean to marsh base $\pm$ SE)	Dominant Vegetation
Pāuatahanui (site mean)	9.6 $\pm$ 0.7	0.60 $\pm$ 0.04	0.44 $\pm$ 0.02	0.04 $\pm$ 0.004	47.8 $\pm$ 8.6	75.9 $\pm$ 16.4	
Low marsh (n=4; 15, 18, 28 & 30 cm)	9.2 $\pm$ 1.2	0.50 $\pm$ 0.06	0.55 $\pm$ 0.04	0.05 $\pm$ 0.01	54.0 $\pm$ 17.8	83.9 $\pm$ 29.0	<i>Juncus kraussii</i>
Mid marsh (n=4; 15, 16, 20 & 44 cm)	11.7 $\pm$ 1.3	0.76 $\pm$ 0.07	0.36 $\pm$ 0.02	0.04 $\pm$ 0.005	45.3 $\pm$ 12.3	86.4 $\pm$ 38.1	<i>Apodasmia similis</i> , <i>Plagianthus divaricatus</i> , <i>Typha orientalis</i>
High marsh (n=4; 16, 20, 24 & 27 cm)	7.3 $\pm$ 1.3	0.49 $\pm$ 0.07	0.43 $\pm$ 0.03	0.04 $\pm$ 0.01	44.4 $\pm$ 18.1	57.4 $\pm$ 18.3	<i>Plagianthus divaricatus</i> , <i>Lolium arundinaceum</i> , <i>Poa annua</i> , <i>Bromus catharticus</i> , <i>Carex coriacea</i>
Robert Findlay (site mean)	10.0 $\pm$ 1.0	0.80 $\pm$ 0.07	0.58 $\pm$ 0.06	0.05 $\pm$ 0.01	39.7 $\pm$ 7.8	40.7 $\pm$ 9.1	
Low marsh (n=3; 10, 5 & 5 cm)	8.1 $\pm$ 1.1	0.60 $\pm$ 0.06	0.70 $\pm$ 0.09	0.05 $\pm$ 0.01	43.6 $\pm$ 9.4	32.1 $\pm$ 14.8	<i>Salicornia quinqueflora</i> , <i>Samolus repens</i>
Mid marsh (n=3; 12, 12 & 10 cm)	11.4 $\pm$ 1.9	0.80 $\pm$ 0.11	0.62 $\pm$ 0.14	0.06 $\pm$ 0.02	45.5 $\pm$ 23.7	48.4 $\pm$ 27.2	<i>Carex divisa</i> , <i>Selliera radicans</i> , <i>Isolepis cernua</i>
High marsh (n=3; 5, 10 & 10 cm)	9.9 $\pm$ 2.0	0.90 $\pm$ 0.14	0.44 $\pm$ 0.04	0.05 $\pm$ 0.01	55.2 $\pm$ 14.7	41.5 $\pm$ 0.64	<i>Polypogon viridis</i> , <i>Epilobium ciliatum</i> , <i>Bromus catharticus</i> , <i>Carex divisa</i> ,
Omaia (site mean)	2.7 $\pm$ 0.4	0.24 $\pm$ 0.04	0.64 $\pm$ 0.04	0.02 $\pm$ 0.002	28.4 $\pm$ 8.0	52.3 $\pm$ 13.6	
Low marsh (n=3; 20, 30 & 34 cm)	2.2 $\pm$ 0.5	0.21 $\pm$ 0.04	0.78 $\pm$ 0.04	0.02 $\pm$ 0.004	32.6 $\pm$ 21.6	58.8 $\pm$ 26.2	Pasture grasses and legumes, <i>Cotula coronopifolia</i> , <i>Lagurus ovatus</i> , <i>Polypogon monspeliensis</i> , <i>Lobelia anceps</i> , patchy <i>Juncus kraussii</i> and <i>Salicornia quinqueflora</i>
Mid marsh (n=3; 14, 20 & 20 cm)	4.3 $\pm$ 0.9	0.40 $\pm$ 0.10	0.56 $\pm$ 0.09	0.02 $\pm$ 0.004	28.0 $\pm$ 7.6	47.9 $\pm$ 17.7	
High marsh (n=3; 20, 22 & 29.5 cm)	2.1 $\pm$ 0.5	0.17 $\pm$ 0.04	0.52 $\pm$ 0.07	0.01 $\pm$ 0.004	24.7 $\pm$ 15.1	50.2 $\pm$ 34.3	
Okatakata (site mean)	5.5 $\pm$ 0.9	0.37 $\pm$ 0.05	0.57 $\pm$ 0.03	0.02 $\pm$ 0.002	30.7 $\pm$ 6.4	51.8 $\pm$ 9.3	
Low marsh (n=3; 30, 30 & 47 cm)	2.1 $\pm$ 0.1	0.19 $\pm$ 0.02	0.72 $\pm$ 0.05	0.02 $\pm$ 0.002	16.0 $\pm$ 10.5	44.0 $\pm$ 25.8	<i>Juncus kraussii</i> , <i>Salicornia quinqueflora</i>
Mid marsh (n=3; 20, 20 & 30 cm)	8.3 $\pm$ 2.3	0.47 $\pm$ 0.11	0.51 $\pm$ 0.04	0.03 $\pm$ 0.01	42.1 $\pm$ 12.3	61.0 $\pm$ 17.3	<i>Apodasmia similis</i> , <i>Machaerina juncea</i>
High marsh (n=3; 15, 20 & 20 cm)	8.0 $\pm$ 2.0	0.60 $\pm$ 0.10	0.38 $\pm$ 0.03	0.02 $\pm$ 0.003	33.8 $\pm$ 5.9	50.4 $\pm$ 10.8	<i>Austroderia splendens</i> , <i>Ficinia nodosa</i> , <i>Cortaderia jubata</i>
Awanui (site mean)	6.9 $\pm$ 0.8	0.30 $\pm$ 0.03	0.55 $\pm$ 0.04	0.05 $\pm$ 0.01	34.0 $\pm$ 27.0	112.0 $\pm$ 100.3	
Low marsh (n=3; 5, 6, and 30 cm)	2.6 $\pm$ 0.8	0.20 $\pm$ 0.06	0.27 $\pm$ 0.04	0.01 $\pm$ 0.002	10.1 $\pm$ 7.1	8.2 $\pm$ 7.2	<i>Salicornia quinqueflora</i> , <i>Juncus kraussii</i> (newly colonised low marsh and juvenile plants for 5 and 6 cm long cores)
Mid marsh (n=3; 40, 45, 95 cm)	7.7 $\pm$ 0.9	0.37 $\pm$ 0.03	0.61 $\pm$ 0.05	0.05 $\pm$ 0.01	63.3 $\pm$ 52.6	215.8 $\pm$ 198.8	<i>Apodasmia similis</i> (40 and 45 cm cores were retrieved from mid marsh zones with patchy vegetation)

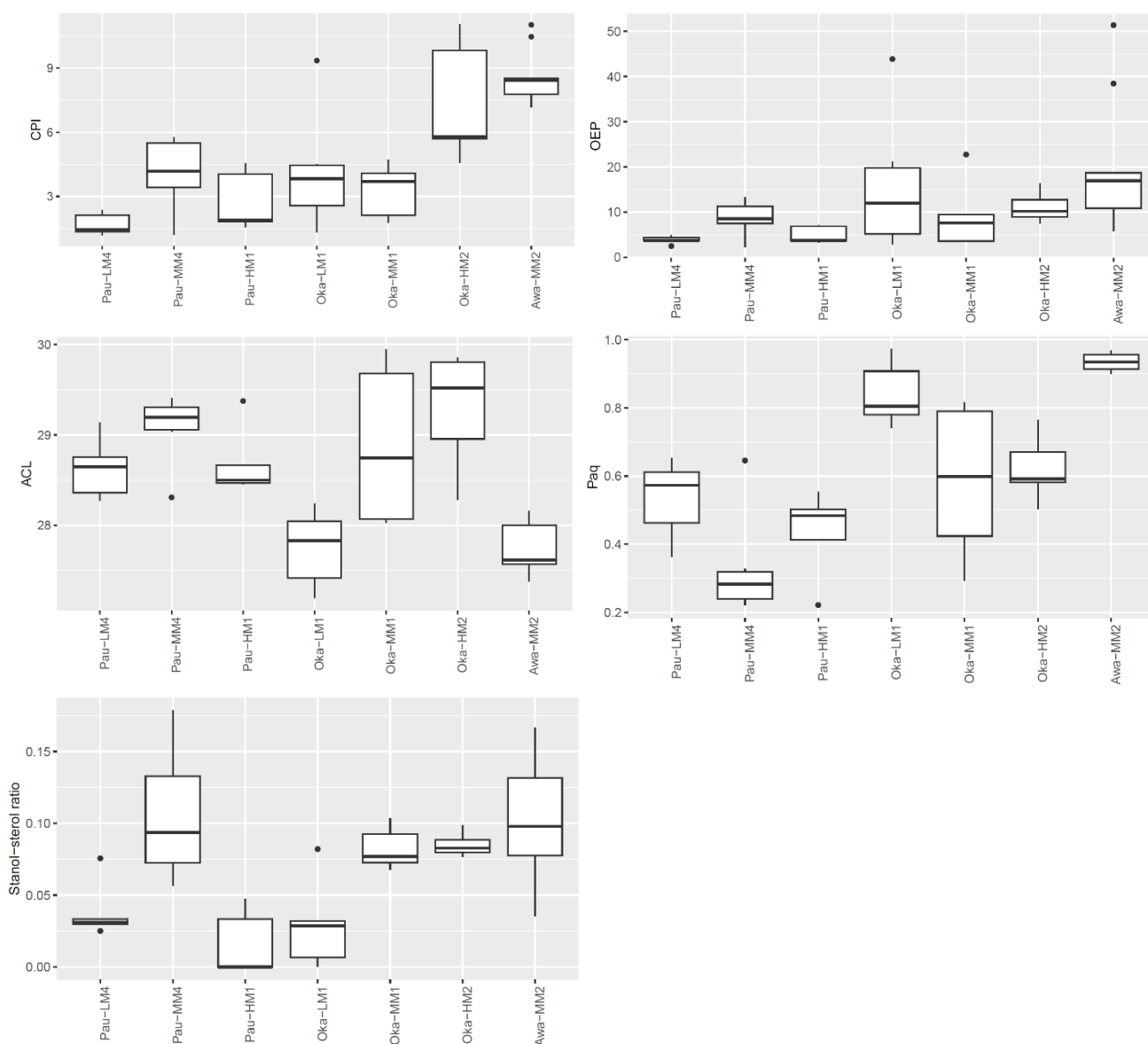


Figure S6: Boxplots showing the values of each biomarker index for all sampled cores at Pāuatahanui (Pau), Okatakata (Oka) and Awanui (Awa) for low marsh (LM), mid marsh (MM) and high marsh (HM). Topmost: P_{aq} (left) and ACL (right); middle: CPI (left) and OEP (right); bottom: stanol-sterol ratio.

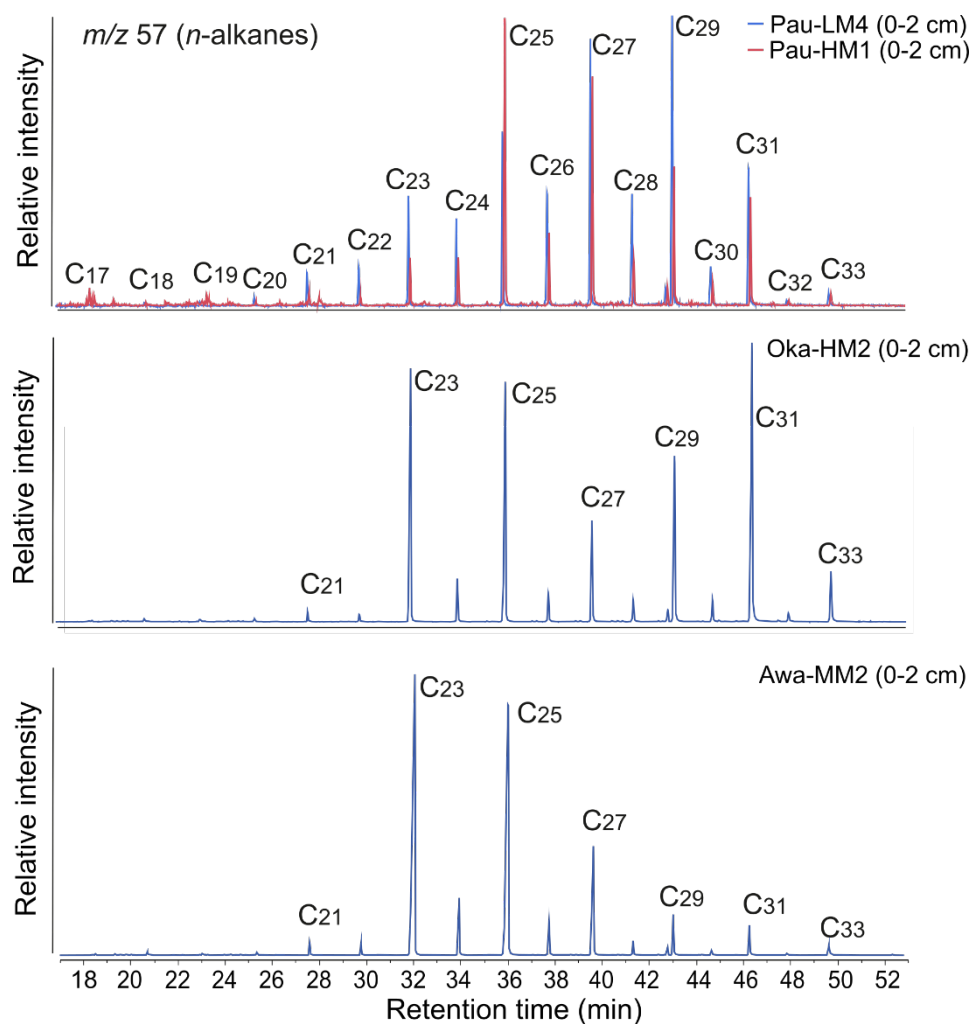


Figure S7: Example ion fragmentograms (m/z 57) for samples from Pāuatahanui (Pau), Okatakata (Oka) and Awanui (Awa) showing the n -alkane distributions present in the apolar fractions of the total lipid extracts (TLEs).

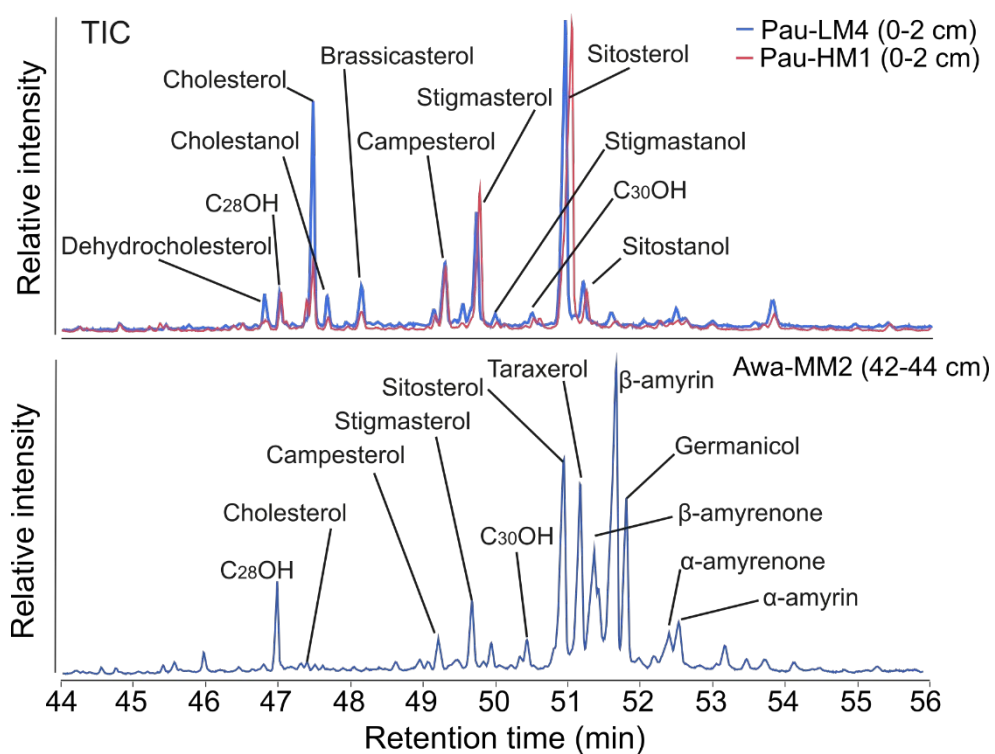


Figure S8: Example of Total Ion Current (TIC) signal for samples from Pāuatahanui (Pau) and Awanui (Awa) showing the distributions of sterols and their respective stanols, as well as plant terpenoids, present in the polar fractions of the total lipid extracts (TLEs).

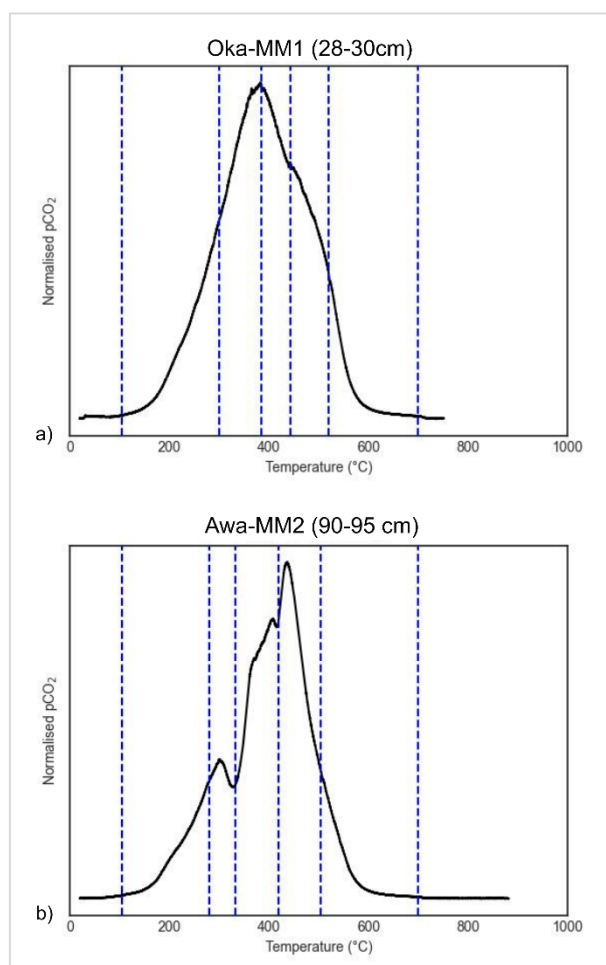


Figure S9: RPO-AMS thermographs for a) Okatakata sample Oka-MM1 (28-30 cm) and b) Awanui sample Awa-MM2 (90-95 cm). The x-axis is the temperature during ramped heating of the sample (°C), with the dotted blue lines representing the obtained pyrolytic splits. The y-axis is the CO₂ evolution normalised to account for sample size differences.

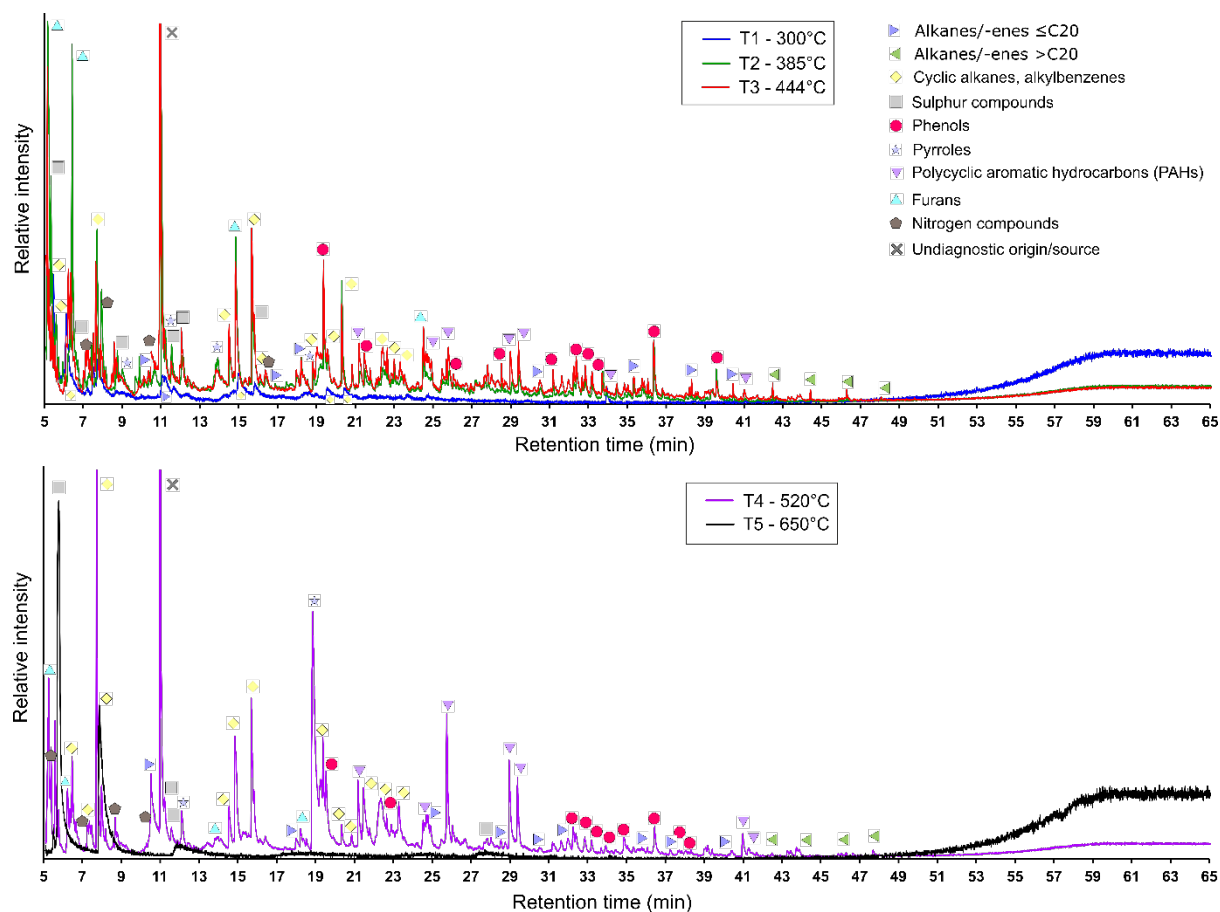


Figure S10: Example chromatograms of the different temperature splits obtained following ramped pyrolysis gas chromatography mass spectrometry (Py-GC-MS). The sample chromatogram is for one sample from Okatakata, Oka-MM2 (28-30 cm).