Linking sediment biodegradability with its origin in shallow coastal environments

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Supplementary Material

Figure S1. Boxplot of the biomarkers proportion (%) and concentration (ng.g⁻¹ of dry sediment) specific to terrestrial plants (A and C) and bacterial matter (B and D) in the lipid pool of sediment samples collected on the 12 studied mudflats. The grey area represents the values between the first and third quartiles calculated overall data.
Figure S2. Boxplot of the biomarkers proportion (%) (A) and concentration (ng.g$^{-1}$ of dry sediment) (B) specific to microalgae (sum of biomarkers of phytoplankton and n-alkanes microalgae) (A and C) in the lipid pool of sediment samples collected on the 12 studied mudflats. The grey area represents the values between the first and third quartiles calculated overall data.

Figure S3. Boxplot of the markers concentration (ng.g$^{-1}$ of dry sediment) specific to fecal matter in the lipid pool of sediment samples collected on the 12 studied mudflats. The grey area represents the values between the first and third quartiles calculated overall data.
Figure S4. Boxplot of the markers proportion (%) (A) and concentration (ng.g\(^{-1}\) of dry sediment) (B) specific to combustion products in the lipid pool of sediment samples collected on the 12 studied mudflats. The grey area represents the values between the first and third quartiles calculated overall data.

Figure S5. Representation in the common space of the co-inertia analysis of the two data matrices: elemental and isotopic ratios (A), and proportions of lipid marker groups (B). The marker groups which contributed most to the two first axis (> 10 %) are represented in red.
Table S1. List of all lipid markers identified in our sediment samples.

| Source Groupe | Fecal matter | Combustion products | Oil and by-products | Bacterial matter | Macrophytes |
|---------------|--------------|---------------------|---------------------|-----------------|-------------|
| Lipid markers| "Fecal"      | "Combustion 1"      | "Petroleum product" | "Bacteria 1"    | "Macrophytes" |
| Coprostanol  | Phénanthrène | Benzo[hnaphtho[2,3-d][thiophene | n-C11               | acide gras C17 iso | nC20-nC23   |
| EpicoProstanol| Anthracène   | Benzo(a)anthracène | n-C12               | acide gras C17   | nC24+nC25+nC26 |
| 24-Ethylcoprostanol | C1-178 | Chrysène | n-C13               | acide gras C15 iso | nC20-nC23   |
| 24-Ethylepicoprostanol | C2-178 | C1-228 | n-C14               | acide gras C15   | nC24+nC25+nC26 |
| Fluoranthène | Benzo(b,j,k)fluoranthène | bicyclobexane | nC27-nC34 | acide gras C17 iso | nC20-nC23   |
| Pyrène      | Benzo(e)pyrène | C2-228       | C20 TT              | acide gras C17   | nC24+nC25+nC26 |
| C1-202      | Benzo(a)pyrène | C1-228       | C21 TT              | acide gras C17   | nC24+nC25+nC26 |
| C2-202      | Peryléne     | C1-252       | C22 TT              | acide gras C17   | nC24+nC25+nC26 |
| C1-252      | Dibenzo[a,h]anthracene | C23 TT   | C23 TT              | acide gras C17   | nC24+nC25+nC26 |
| Indeno[1,2,3-cd]pyrene | C1-276 | 18a-trisnorhopane | C24 TT              | acide gras C17   | nC24+nC25+nC26 |
| Benzo[ghi]perylene | C2-202 | 17b-trisnorhopane | C25 TT              | acide gras C17   | nC24+nC25+nC26 |
| C1-276      | 17a,21b-30norhopane | 17a,21b-hopane | 17a,21b-30norhopane | acide gras C17   | nC24+nC25+nC26 |
| C2-202      | 22S-17a(H), 21b(H)-30-homohopane (C31) | 22S-17a(H), 21b(H)-30-homohopane (C31) | 22S-17a(H), 21b(H)-30-homohopane (C31) | acide gras C17 iso | nC24+nC25+nC26 |
| C1-252      | 22S-17a(H), 21b(H)-30-homohopane (C31) | 22S-17a(H), 21b(H)-30-homohopane (C31) | 22S-17a(H), 21b(H)-30-homohopane (C31) | acide gras C17 iso | nC24+nC25+nC26 |
| C1-276      | 22S-17a(H), 21b(H)-30-bishomohopane (C32) | 22S-17a(H), 21b(H)-30-bishomohopane (C32) | 22S-17a(H), 21b(H)-30-bishomohopane (C32) | acide gras C17 iso | nC24+nC25+nC26 |
| C2-202      | 22S-17a(H), 21b(H)-30-trishomohopane (C33) | 22S-17a(H), 21b(H)-30-trishomohopane (C33) | 22S-17a(H), 21b(H)-30-trishomohopane (C33) | acide gras C17 iso | nC24+nC25+nC26 |
| Source Groupe | Terrestrial plants | Phytoplankton | Pelagic and benthic microalgae | Algal matter (micro and macro) | Green macroalgae |
|--------------|-------------------|---------------|-------------------------------|--------------------------------|------------------|
| Lipid markers | nC24+nC25+nC26   | Campestérol   | wOHC16:0  | n-C15                          | néophytadiène 01  |
| nC27-nC34    | nC35              | Stigmastérol  | a,wC16:0  | n-C16                          | néophytadiène 02  |
|              |                   | alcool-C20    | ac C20      | n-C17                          | néophytadiène 03  |
|              |                   | alcool-C21    | ac C21      | n-C18                          |                  |
|              |                   | alcool-C22    | ac C22      | n-C19                          |                  |
|              |                   | alcool-C23    | wOHC18:0   |                  |                  |
|              |                   | alcool-C24    | a,w C18:0  |                  |                  |
|              |                   | alcool-C25    | ac C21      |                  |                  |
|              |                   | alcool-C26    | ac C22      |                  |                  |
|              |                   | alcool-C27    | wOHC20:0   |                  |                  |
|              |                   | alcool-C28    | ac C23      |                  |                  |
|              |                   | alcool-C29    | a,w C20:0  |                  |                  |
|              |                   | alcool-C30    | ac C24      |                  |                  |
|              |                   | wOHC22:0     | ac C25      |                  |                  |
|              |                   | a,w C22:0    | ac C26      |                  |                  |
|              |                   | wOHC24:0     | ac C27      |                  |                  |
|              |                   | a,w C24:0    | ac C28      |                  |                  |
|              |                   | a,w C26:0    | ac C29      |                  |                  |
|              |                   | a,w C26:0    | ac C30      |                  |                  |

Table S1 (continued)
Table S2. Results of the hierarchical cluster analysis on the canonical ordination.

| Sample | Site | Mudflat       | Cluster |
|--------|------|---------------|---------|
| 1_1    | #1   | Trieux Estuary | "III"   |
| 1_2    | #1   | Trieux Estuary | "III"   |
| 1_3    | #1   | Trieux Estuary | "III"   |
| 1_4    | #1   | Trieux Estuary | "II"    |
| 1_5    | #1   | Trieux Estuary | "II"    |
| 2_1    | #2   | Trieux Estuary | "III"   |
| 2_2    | #2   | Trieux Estuary | "I"     |
| 2_3    | #2   | Trieux Estuary | "III"   |
| 2_4    | #2   | Trieux Estuary | "III"   |
| 2_5    | #2   | Trieux Estuary | "III"   |
| 3_1    | #3   | Trieux Estuary | "II"    |
| 3_2    | #3   | Trieux Estuary | "II"    |
| 3_3    | #3   | Trieux Estuary | "II"    |
| 3_4    | #3   | Trieux Estuary | "II"    |
| 3_5    | #3   | Trieux Estuary | "II"    |
| 4_1    | #4   | Trieux Estuary | "II"    |
| 4_2    | #4   | Trieux Estuary | "II"    |
| 4_3    | #4   | Trieux Estuary | "II"    |
| 4_4    | #4   | Trieux Estuary | "II"    |
| 4_5    | #4   | Trieux Estuary | "II"    |
| 5_1    | #5   | Ria Etel       | "II"    |
| 5_2    | #5   | Ria Etel       | "II"    |
| 5_3    | #5   | Ria Etel       | "II"    |
| 5_4    | #5   | Ria Etel       | "II"    |
| 6_1    | #6   | Ria Etel       | "II"    |
| 6_2    | #6   | Ria Etel       | "II"    |
| 6_3    | #6   | Ria Etel       | "II"    |
| 6_4    | #6   | Ria Etel       | "II"    |
| 7_1    | #7   | Ria Etel       | "II"    |
| 7_2    | #7   | Ria Etel       | "II"    |
| 7_3    | #7   | Ria Etel       | "II"    |
| 7_4    | #7   | Ria Etel       | "II"    |
| 8_1    | #8   | Ria Etel       | "II"    |
| 8_2    | #8   | Ria Etel       | "II"    |
| 8_3    | #8   | Ria Etel       | "II"    |
| 8_4    | #8   | Ria Etel       | "II"    |
| 9_1    | #9   | Ria Etel       | "II"    |
| 9_2    | #9   | Ria Etel       | "II"    |
| 9_3    | #9   | Ria Etel       | "II"    |
| 9_4    | #9   | Ria Etel       | "II"    |
Table S2 (continued)

|   |   |   |   |
|---|---|---|---|
| 10_1 | #10 | Lorient Bay | “IV” |
| 10_2 | #10 | Lorient Bay | “IV” |
| 10_3 | #10 | Lorient Bay | “III” |
| 10_4 | #10 | Lorient Bay | “IV” |
| 11_1 | #11 | Lorient Bay | “III” |
| 11_2 | #11 | Lorient Bay | “III” |
| 11_3 | #11 | Lorient Bay | “III” |
| 12_1 | #12 | Lorient Bay | “II” |
| 12_2 | #12 | Lorient Bay | “II” |
| 12_3 | #12 | Lorient Bay | “II” |
| 12_4 | #12 | Lorient Bay | “II” |
| 13_1 | #13 | Lorient Bay | “III” |
| 13_2 | #13 | Lorient Bay | “III” |
| 13_3 | #13 | Lorient Bay | “III” |
| 13_4 | #13 | Lorient Bay | “III” |
| 14_1 | #14 | Lorient Bay | “III” |
| 14_2 | #14 | Lorient Bay | “III” |
| 14_3 | #14 | Lorient Bay | “I” |
| 14_4 | #14 | Lorient Bay | “III” |
| 15_1 | #15 | Morlaix Bay | “II” |
| 15_2 | #15 | Morlaix Bay | “II” |
| 15_3 | #15 | Morlaix Bay | “II” |
| 15_4 | #15 | Morlaix Bay | “II” |
| 16_1 | #16 | Morlaix Bay | “II” |
| 16_2 | #16 | Morlaix Bay | “II” |
| 16_3 | #16 | Morlaix Bay | “III” |
| 16_4 | #16 | Morlaix Bay | “II” |
| 16_5 | #16 | Morlaix Bay | “II” |
| 17_1 | #17 | Morlaix Bay | “II” |
| 17_2 | #17 | Morlaix Bay | “II” |
| 17_3 | #17 | Morlaix Bay | “II” |
| 17_4 | #17 | Morlaix Bay | “II” |
| 17_5 | #17 | Morlaix Bay | “II” |
| 18_1 | #18 | Morlaix Bay | “II” |
| 18_2 | #18 | Morlaix Bay | “II” |
| 18_3 | #18 | Morlaix Bay | “II” |
| 18_4 | #18 | Morlaix Bay | “II” |
| 18_5 | #18 | Morlaix Bay | “II” |
| 19_1 | #19 | Morlaix Bay | “II” |
| 19_2 | #19 | Morlaix Bay | “II” |
| 19_3 | #19 | Morlaix Bay | “II” |
| 19_4 | #19 | Morlaix Bay | “II” |
| 19_5 | #19 | Morlaix Bay | “II” |
| 20_1 | #20 | Morlaix Bay | “III” |
| 20_2 | #20 | Morlaix Bay | “II” |
| 20_3 | #20 | Morlaix Bay | “II” |
| 20_4 | #20 | Morlaix Bay | “II” |
| 20_5 | #20 | Morlaix Bay | “II” |
| 21_1 | #21 | Goulven Bay | “III” |
| 21_2 | #21 | Goulven Bay | “III” |
| 21_3 | #21 | Goulven Bay | “I” |
| 21_4 | #21 | Goulven Bay | “I” |
| 21_5 | #21 | Goulven Bay | “III” |
Table S2 (continued)

|   |   |   |           |   |
|---|---|---|-----------|---|
| 22_1 | #22 | Aber Wrac'h | "II" |
| 22_2 | #22 | Aber Wrac'h | "II" |
| 22_3 | #22 | Aber Wrac'h | "II" |
| 22_4 | #22 | Aber Wrac'h | "II" |
| 22_5 | #22 | Aber Wrac'h | "II" |
| 23_1 | #23 | Aber Wrac'h | "II" |
| 23_2 | #23 | Aber Wrac'h | "II" |
| 23_3 | #23 | Aber Wrac'h | "II" |
| 23_4 | #23 | Aber Wrac'h | "II" |
| 23_5 | #23 | Aber Wrac'h | "I"  |
| 24_1 | #24 | Aber Wrac'h | "II" |
| 24_2 | #24 | Aber Wrac'h | "II" |
| 24_3 | #24 | Aber Wrac'h | "II" |
| 24_4 | #24 | Aber Wrac'h | "II" |
| 24_5 | #24 | Aber Wrac'h | "II" |
| 25_1 | #25 | Pont L'Abbe | "III" |
| 25_2 | #25 | Pont L'Abbe | "III" |
| 25_3 | #25 | Pont L'Abbe | "III" |
| 25_4 | #25 | Pont L'Abbe | "III" |
| 26_1 | #26 | Pont L'Abbe | "I"  |
| 26_2 | #26 | Pont L'Abbe | "I"  |
| 26_3 | #26 | Pont L'Abbe | "I"  |
| 26_4 | #26 | Pont L'Abbe | "I"  |
| 27_1 | #27 | Pont L'Abbe | "III" |
| 27_2 | #27 | Pont L'Abbe | "III" |
| 27_3 | #27 | Pont L'Abbe | "I"  |
| 27_4 | #27 | Pont L'Abbe | "III" |
| 28_1 | #28 | Pont L'Abbe | "I"  |
| 28_2 | #28 | Pont L'Abbe | "III" |
| 28_3 | #28 | Pont L'Abbe | "I"  |
| 28_4 | #28 | Pont L'Abbe | "I"  |
| 29_1 | #29 | Port la Foret | "II" |
| 29_2 | #29 | Port la Foret | "II" |
| 29_3 | #29 | Port la Foret | "II" |
| 29_4 | #29 | Port la Foret | "II" |
| 29_5 | #29 | Port la Foret | "II" |
| 30_1 | #30 | Port la Foret | "II" |
| 30_2 | #30 | Port la Foret | "II" |
| 30_3 | #30 | Port la Foret | "I"  |
| 30_4 | #30 | Port la Foret | "III" |
| 30_5 | #30 | Port la Foret | "I"  |
| 31_1 | #31 | Port la Foret | "I"  |
| 31_2 | #31 | Port la Foret | "I"  |
| 31_3 | #31 | Port la Foret | "III" |
| 31_4 | #31 | Port la Foret | "I"  |
| 31_5 | #31 | Port la Foret | "I"  |
| 32_1 | #32 | Rance Estuary | "III" |
| 32_2 | #32 | Rance Estuary | "III" |
| 32_3 | #32 | Rance Estuary | "III" |
| 32_4 | #32 | Rance Estuary | "III" |
| 33_1 | #33 | Rance Estuary | "III" |
| 33_2 | #33 | Rance Estuary | "III" |
| 33_3 | #33 | Rance Estuary | "III" |
| 33_4 | #33 | Rance Estuary | "III" |
|   |   |   |   |
|---|---|---|---|
| 34_1 | #34 | Rance Estuary | "III" |
| 34_2 | #34 | Rance Estuary | "III" |
| 34_3 | #34 | Rance Estuary | "III" |
| 34_4 | #34 | Rance Estuary | "III" |
| 35_1 | #35 | Rance Estuary | "III" |
| 35_2 | #35 | Rance Estuary | "III" |
| 35_3 | #35 | Rance Estuary | "III" |
| 35_4 | #35 | Rance Estuary | "III" |
| 36_1 | #36 | Rance Estuary | "II" |
| 36_2 | #36 | Rance Estuary | "II" |
| 36_3 | #36 | Rance Estuary | "II" |
| 36_4 | #36 | Rance Estuary | "II" |
| 37_1 | #37 | Auray River | "II" |
| 37_2 | #37 | Auray River | "III" |
| 37_3 | #37 | Auray River | "III" |
| 37_4 | #37 | Auray River | "III" |
| 38_1 | #38 | Auray River | "II" |
| 38_2 | #38 | Auray River | "II" |
| 38_3 | #38 | Auray River | "II" |
| 38_4 | #38 | Auray River | "II" |
| 39_1 | #39 | Auray River | "II" |
| 39_2 | #39 | Auray River | "II" |
| 39_3 | #39 | Auray River | "II" |
| 39_4 | #39 | Auray River | "II" |
| 39_5 | #39 | Auray River | "II" |
| 40_1 | #40 | Vannes Estuary | "II" |
| 40_2 | #40 | Vannes Estuary | "II" |
| 40_3 | #40 | Vannes Estuary | "II" |
| 40_4 | #40 | Vannes Estuary | "II" |
| 41_1 | #41 | Vannes Estuary | "IV" |
| 41_2 | #41 | Vannes Estuary | "IV" |
| 41_3 | #41 | Vannes Estuary | "IV" |
| 41_4 | #41 | Vannes Estuary | "IV" |
| 42_1 | #42 | Vannes Estuary | "II" |
| 42_2 | #42 | Vannes Estuary | "II" |
| 43_1 | #43 | Gulf of Morbihan | "II" |
| 43_2 | #43 | Gulf of Morbihan | "II" |
| 43_3 | #43 | Gulf of Morbihan | "IV" |
| 43_4 | #43 | Gulf of Morbihan | "IV" |
| 44_1 | #44 | Gulf of Morbihan | "II" |
| 44_2 | #44 | Gulf of Morbihan | "II" |
| 44_3 | #44 | Gulf of Morbihan | "IV" |
| 44_4 | #44 | Gulf of Morbihan | "IV" |
| 45_1 | #45 | Gulf of Morbihan | "II" |
| 45_2 | #45 | Gulf of Morbihan | "II" |
| 45_3 | #45 | Gulf of Morbihan | "II" |
| 45_4 | #45 | Gulf of Morbihan | "II" |