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*Supplement of*

# Organic carbon production, mineralisation and preservation on the Peruvian margin

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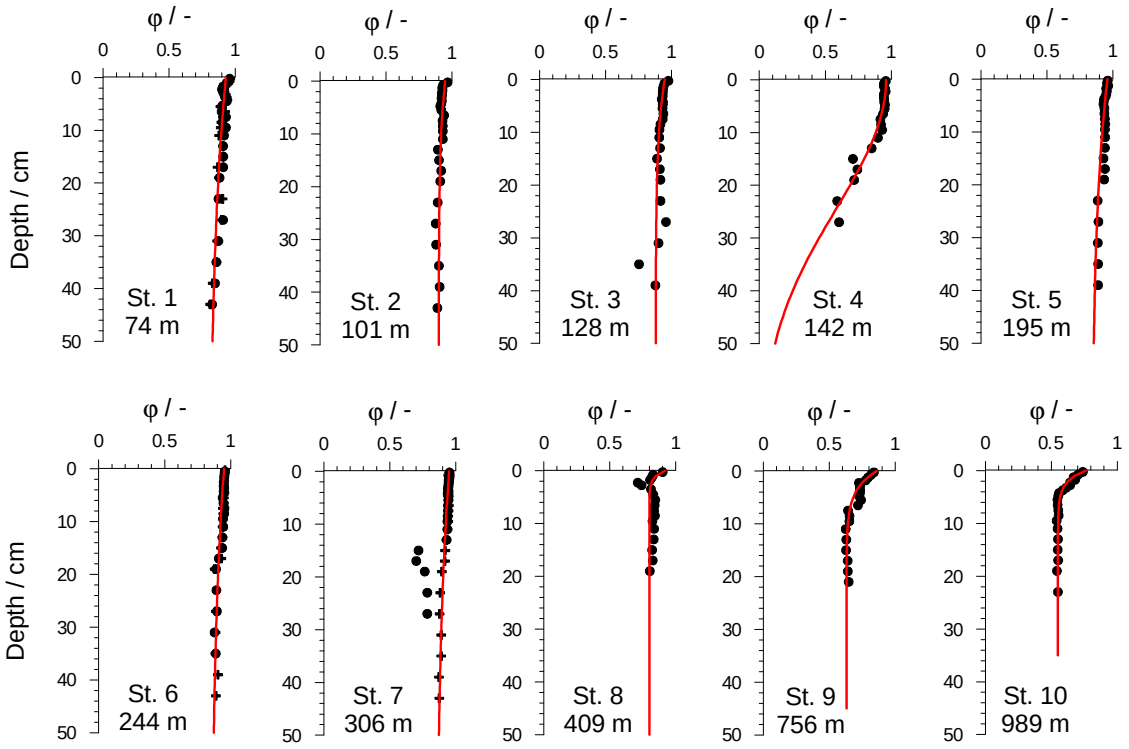


Figure S1. Measured (symbols) and modeled porosity at 12°S using the parameters listed in Table S2 (see Bohlen et al. (2011) for porosity parameters at 11°S). Data correspond to the multiple-cores (MUC) listed in Table 1 in the main text where different symbol types signify repeated coring at the same station.

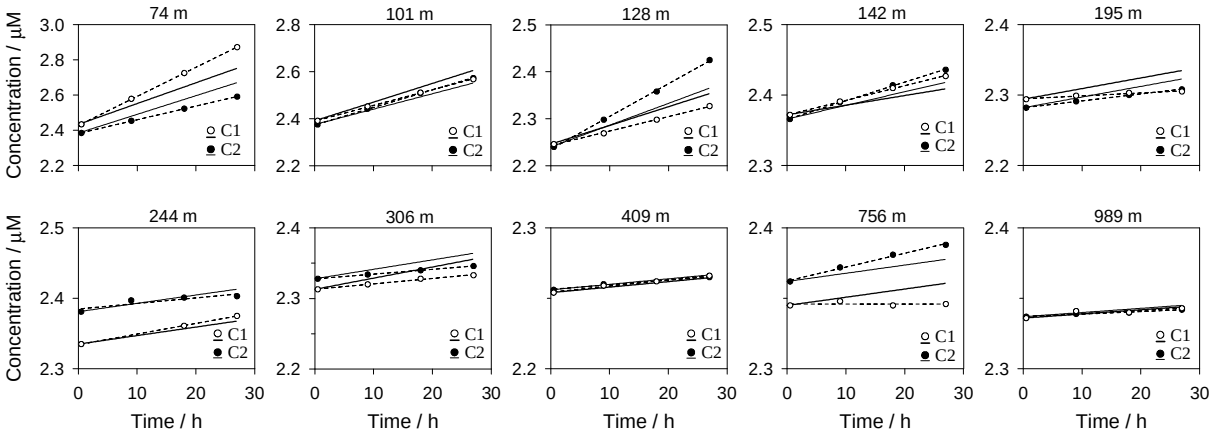


Figure S2. Dissolved inorganic carbon (DIC) concentrations inside the benthic chambers from 12°S (symbols). Open and filled circles refer to chamber 1 and 2, respectively. The dashed lines denote linear regression curves through the data from which the fluxes in Table 2 were calculated. The solid lines are the predicted changes in concentration using the DIC fluxes computed by the numerical model.

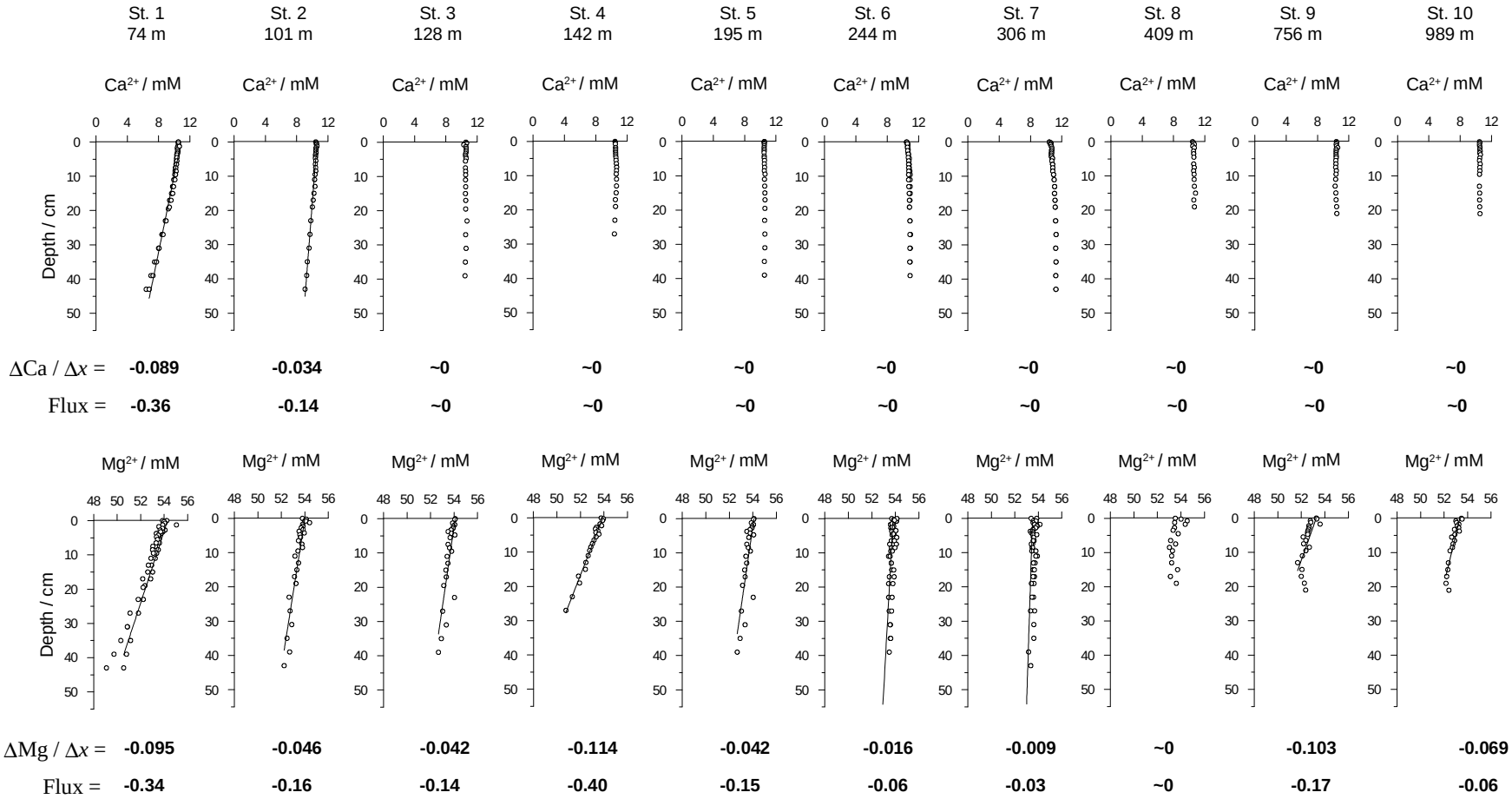


Figure S3. Dissolved porewater calcium ($Ca^{2+}$) and magnesium ($Mg^{2+}$) concentrations at 12°S. The solid lines denote linear regression curves where a concentration gradient ($\Delta Ca/\Delta x$, $\Delta Mg/\Delta x$) was apparent. The concentration gradients are given (in μmol $cm^4$) from which the diffusive fluxes were calculated (in mmol $m^{-2}$ $d^{-1}$) using Fick's First Law and diffusion coefficients corrected for site-specific tortuosity and temperature.

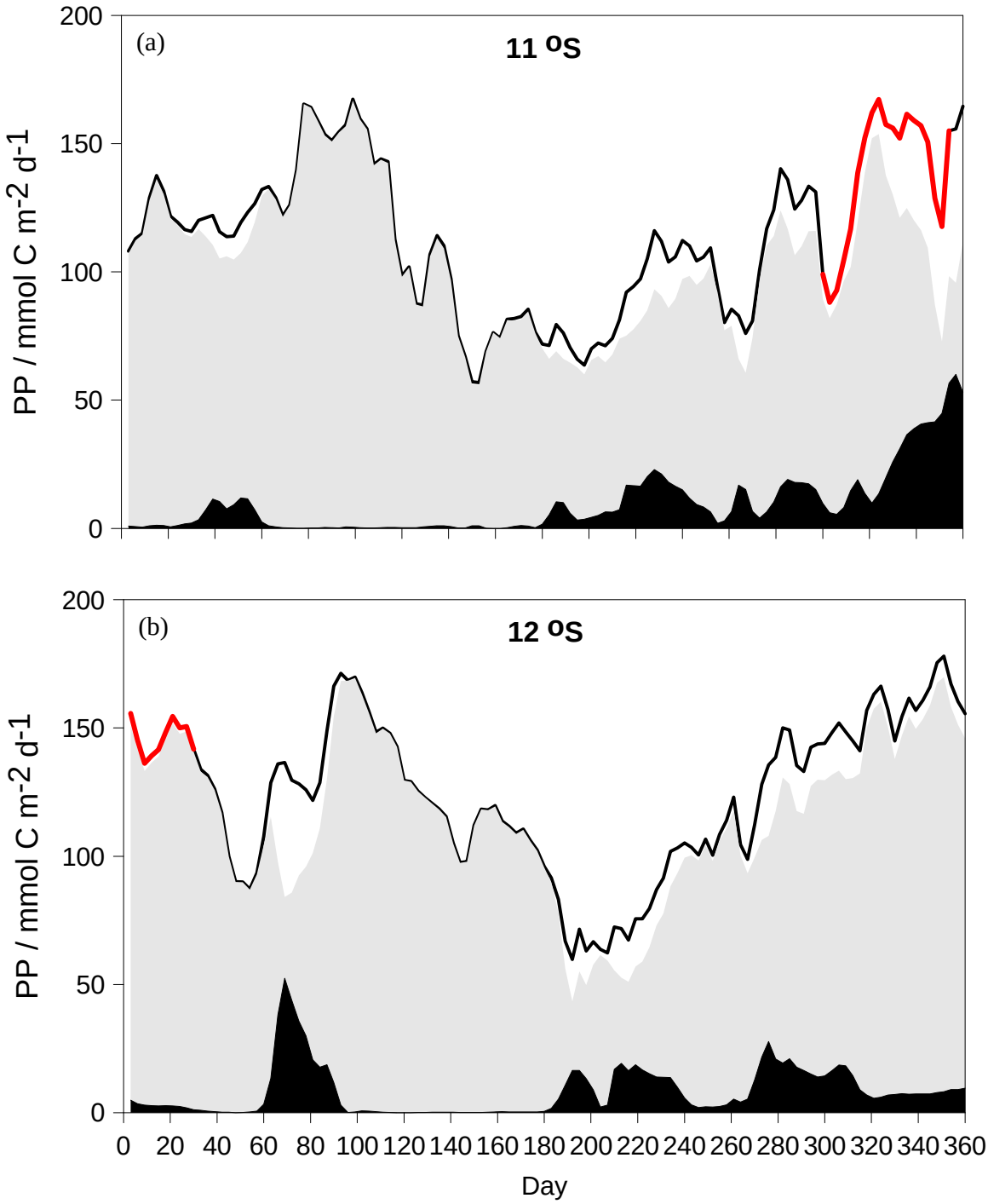


Figure S4. Three-day moving average primary production (mmol C $m^{-2}$ $d^{-1}$) at ca. 100 m water depth on the 11 and 12 $^{o}$S transects calculated by the ROMS-BioEBUS model (thick black line). The contribution from small and large phytoplankton groups are shown in black and grey, respectively. The red lines show the periods when the fieldwork was conducted.

Table S1. Measured TA and $pCO_2$ concentrations in the benthic chambers at 12°S. TA measured in the syringe samples was corrected for dilution by distilled water in the Vygon tubes (see main text) using the chloride concentration. Linear regression of the syringe samples was used to adjust TA to the times when the glass tubes samples were withdrawn for $pCO_2$ analysis. DIC was calculated as described in the main text. (C1 = chamber 1, C2 = chamber 2).

| BIGO I-II (74 m) | Time syringes (h) | TA corrected (mM) | Time tubes (h) | TA (mM) | $pCO_2$ (ppm) | DIC (µM) |
|---|---|---|---|---|---|---|
| C1_1 | 0.25 | 2.31 | 0.5 | 2.474 | 1402 | 2434 |
| C1_2 | 4 | 2.57 | | | | |
| C1_3 | 8 | 2.70 | 9 | 2.631 | 1561 | 2579 |
| C1_4 | 12 | 2.78 | | | | |
| C1_5 | 16 | 2.77 | 18 | 2.798 | 1654 | 2725 |
| C1_6 | 20 | 2.88 | | | | |
| C1_7 | 24 | 2.86 | | | | |
| C1_8 | 28 | 2.92 | 27 | 2.964 | 1757 | 2872 |
| C2_1 | 0.25 | 2.39 | 0.5 | 2.433 | 1367 | 2385 |
| C2_2 | 4 | 2.45 | | | | |
| C2_3 | 8 | 2.55 | 9 | 2.510 | 1469 | 2454 |
| C2_4 | 12 | 2.57 | | | | |
| C2_5 | 16 | 2.59 | 18 | 2.591 | 1550 | 2523 |
| C2_6 | 20 | 2.59 | | | | |
| C2_7 | 24 | 2.58 | | | | |
| C2_8 | 28 | 2.72 | 27 | 2.672 | 1621 | 2591 |

| BIGO I-V (101 m) | Time syringes (h) | TA corrected (mM) | Time tubes (h) | TA (mM) | $pCO_2$ (ppm) | DIC (µM) |
|---|---|---|---|---|---|---|
| C1_1 | 0.25 | 2.46 | 0.5 | 2.450 | 1211 | 2391 |
| C1_2 | 4 | 2.48 | | | | |
| C1_3 | 8 | 2.51 | 9 | 2.511 | 1285 | 2452 |
| C1_4 | 12 | 2.48 | | | | |
| C1_5 | 16 | 2.60 | 18 | 2.576 | 1347 | 2511 |
| C1_6 | 20 | 2.57 | | | | |
| C1_7 | 24 | 2.64 | | | | |
| C1_8 | 28 | 2.64 | 27 | 2.641 | 1399 | 2568 |
| C2_1 | 0.25 | 2.36 | 0.5 | 2.434 | 1201 | 2375 |
| C2_2 | 4 | 2.52 | | | | |
| C2_3 | 8 | 2.60 | 9 | 2.499 | 1274 | 2442 |
| C2_4 | 12 | 2.46 | | | | |
| C2_5 | 16 | 2.48 | 18 | 2.569 | 1326 | 2509 |
| C2_6 | 20 | 2.57 | | | | |
| C2_7 | 24 | 2.69 | | | | |
| C2_8 | 28 | 2.62 | 27 | 2.638 | 1366 | 2573 |

| BIGO II-IV (128 m) | Time syringes (h) | TA corrected (mM) | Time tubes (h) | TA (mM) | $pCO_2$ (ppm) | DIC (µM) |
|---|---|---|---|---|---|---|
| C1_1 | 0.25 | 2.24 | 0.5 | 2.287 | 1260 | 2246 |
| C1_2 | 4 | 2.33 | | | | |
| C1_3 | 8 | 2.32 | 9 | 2.316 | 1223 | 2269 |
| C1_4 | 12 | 2.42 | | | | |
| C1_5 | 16 | 2.42 | 18 | 2.346 | 1230 | 2298 |
| C1_6 | 20 | 2.35 | | | | |
| C1_7 | 24 | 2.47 | | | | |
| C1_8 | 28 | 2.48 | 27 | 2.377 | 1275 | 2327 |
| C2_1 | 0.25 | 2.35 | 0.5 | 2.276 | 1305 | 2240 |
| C2_2 | 4 | 2.25 | | | | |
| C2_3 | 8 | 2.29 | 9 | 2.340 | 1287 | 2298 |
| C2_4 | 12 | 2.31 | | | | |
| C2_5 | 16 | 2.30 | 18 | 2.408 | 1254 | 2358 |
| C2_6 | 20 | 2.41 | | | | |
| C2_7 | 24 | 2.44 | | | | |
| C2_8 | 28 | 2.33 | 27 | 2.475 | 1301 | 2425 |

| BIGO I-I (142 m) | Time syringes (h) | TA corrected (mM) | Time tubes (h) | TA (mM) | $pCO_2$ (ppm) | DIC (µM) |
|---|---|---|---|---|---|---|
| C1_1 | 0.25 | 2.40 | 0.5 | 2.391 | 1570 | 2372 |
| C1_2 | 4 | 2.43 | | | | |
| C1_3 | 8 | 2.39 | 9 | 2.404 | 1656 | 2391 |
| C1_4 | 12 | 2.39 | | | | |
| C1_5 | 16 | 2.39 | 18 | 2.418 | 1719 | 2410 |
| C1_6 | 20 | 2.41 | | | | |
| C1_7 | 24 | 2.40 | | | | |
| C1_8 | 28 | 2.48 | 27 | 2.431 | 1786 | 2427 |
| C2_1 | 0.25 | 2.33 | 0.5 | 2.383 | 1594 | 2366 |
| C2_2 | 4 | 2.41 | | | | |
| C2_3 | 8 | 2.49 | 9 | 2.399 | 1701 | 2390 |
| C2_4 | 12 | 2.39 | | | | |
| C2_5 | 16 | 2.37 | 18 | 2.415 | 1808 | 2414 |
| C2_6 | 20 | 2.40 | | | | |
| C2_7 | 24 | 2.41 | | | | |
| C2_8 | 28 | 2.47 | 27 | 2.431 | 1908 | 2436 |

| BIGO I-IV (195 m) | Time syringes (h) | TA corrected (mM) | Time tubes (h) | TA (mM) | $pCO_2$ (ppm) | DIC (µM) |
|---|---|---|---|---|---|---|
| C1_1 | 0.25 | 2.34 | 0.5 | 2.325 | 1366 | 2294 |
| C1_2 | 4 | 2.31 | | | | |
| C1_3 | 8 | 2.33 | 9 | 2.325 | 1410 | 2299 |
| C1_4 | 12 | 2.36 | | | | |
| C1_5 | 16 | 2.31 | 18 | 2.325 | 1459 | 2303 |
| C1_6 | 20 | 2.31 | | | | |
| C1_7 | 24 | 2.31 | | | | |
| C1_8 | 28 | 2.32 | 27 | 2.325 | 1476 | 2305 |
| C2_1 | 0.25 | 2.31 | 0.5 | 2.317 | 1319 | 2282 |
| C2_2 | 4 | 2.32 | | | | |
| C2_3 | 8 | 2.37 | 9 | 2.324 | 1342 | 2291 |
| C2_4 | 12 | 2.30 | | | | |
| C2_5 | 16 | 2.28 | 18 | 2.332 | 1351 | 2300 |
| C2_6 | 20 | 2.32 | | | | |
| C2_7 | 24 | 2.37 | | | | |
| C2_8 | 28 | 2.34 | 27 | 2.340 | 1359 | 2308 |

| BIGO II-II (244 m) | Time syringes (h) | TA corrected (mM) | Time tubes (h) | TA (mM) | $pCO_2$ (ppm) | DIC (µM) |
|---|---|---|---|---|---|---|
| C1_1 | 0.25 | 2.39 | 0.5 | 2.371 | 1329 | 2335 |
| C1_2 | 4 | 2.36 | | | | |
| C1_3 | 8 | 2.36 | 9 | | | |
| C1_4 | 12 | 2.37 | | | | |
| C1_5 | 16 | 2.42 | 18 | 2.390 | 1407 | 2361 |
| C1_6 | 20 | 2.38 | | | | |
| C1_7 | 24 | 2.41 | | | | |
| C1_8 | 28 | 2.39 | 27 | 2.400 | 1453 | 2375 |
| C2_1 | 0.25 | 2.36 | 0.5 | 2.418 | 1338 | 2381 |
| C2_2 | 4 | 2.48 | | | | |
| C2_3 | 8 | 2.47 | 9 | 2.418 | 1509 | 2397 |
| C2_4 | 12 | 2.39 | | | | |
| C2_5 | 16 | 2.38 | 18 | 2.418 | 1551 | 2401 |
| C2_6 | 20 | 2.42 | | | | |
| C2_7 | 24 | 2.45 | | | | |
| C2_8 | 28 | 2.40 | 27 | 2.418 | 1583 | 2403 |

| BIGO II-I (306 m) | Time syringes (h) | TA corrected (mM) | Time tubes (h) | TA (mM) | $pCO_2$ (ppm) | DIC (µM) |
|---|---|---|---|---|---|---|
| C1_1 | 0.25 | 2.44 | 0.5 | 2.367 | 1134 | 2313 |
| C1_2 | 4 | 2.32 | | | | |
| C1_3 | 8 | 2.33 | 9 | 2.373 | 1153 | 2320 |
| C1_4 | 12 | 2.37 | | | | |
| C1_5 | 16 | 2.37 | 18 | 2.379 | 1169 | 2328 |
| C1_6 | 20 | 2.41 | | | | |
| C1_7 | 24 | 2.41 | | | | |
| C1_8 | 28 | 2.37 | 27 | 2.385 | 1169 | 2333 |
| C2_1 | 0.25 | 2.39 | 0.5 | 2.385 | 1122 | 2328 |
| C2_2 | 4 | 2.38 | | | | |
| C2_3 | 8 | 2.38 | 9 | 2.389 | 1143 | 2334 |
| C2_4 | 12 | 2.41 | | | | |
| C2_5 | 16 | 2.40 | 18 | 2.393 | 1159 | 2340 |
| C2_6 | 20 | 2.37 | | | | |
| C2_7 | 24 | 2.40 | | | | |
| C2_8 | 28 | 2.40 | 27 | 2.398 | 1173 | 2346 |

| BIGO II-V (409 m) | Time syringes (h) | TA corrected (mM) | Time tubes (h) | TA (mM) | $pCO_2$ (ppm) | DIC (µM) |
|---|---|---|---|---|---|---|
| C1_1 | 0.25 | 2.27 | 0.5 | 2.264 | 1367 | 2254 |
| C1_2 | 4 | 2.27 | | | | |
| C1_3 | 8 | 2.30 | 9 | 2.266 | 1394 | 2259 |
| C1_4 | 12 | 2.26 | | | | |
| C1_5 | 16 | 2.31 | 18 | 2.269 | 1401 | 2262 |
| C1_6 | 20 | 2.34 | | | | |
| C1_7 | 24 | 2.37 | | | | |
| C1_8 | 28 | 2.29 | 27 | 2.272 | 1406 | 2266 |
| C2_1 | 0.25 | 2.40 | 0.5 | 2.264 | 1387 | 2256 |
| C2_2 | 4 | 2.26 | | | | |
| C2_3 | 8 | 2.45 | 9 | 2.266 | 1409 | 2260 |
| C2_4 | 12 | 2.23 | | | | |
| C2_5 | 16 | 2.31 | 18 | | | |
| C2_6 | 20 | 2.32 | | | | |
| C2_7 | 24 | 2.24 | | | | |
| C2_8 | 28 | 2.26 | 27 | 2.272 | 1398 | 2265 |

| BIGO II-III (756 m) | Time syringes (h) | TA corrected (mM) | Time tubes (h) | TA (mM) | $pCO_2$ (ppm) | DIC (µM) |
|---|---|---|---|---|---|---|
| C1_1 | 0.25 | 2.43 | 0.5 | 2.356 | 1138 | 2345 |
| C1_2 | 4 | 2.32 | | | | |
| C1_3 | 8 | 2.41 | 9 | 2.356 | 1161 | 2348 |
| C1_4 | 12 | 2.30 | | | | |
| C1_5 | 16 | 2.35 | 18 | 2.356 | 1139 | 2345 |
| C1_6 | 20 | 2.34 | | | | |
| C1_7 | 24 | 2.37 | | | | |
| C1_8 | 28 | 2.33 | 27 | 2.356 | 1150 | 2346 |
| C2_1 | 0.25 | 2.37 | 0.5 | 2.373 | 1144 | 2362 |
| C2_2 | 4 | 2.38 | | | | |
| C2_3 | 8 | 2.33 | 9 | 2.381 | 1163 | 2372 |
| C2_4 | 12 | 2.41 | | | | |
| C2_5 | 16 | 2.39 | 18 | 2.389 | 1175 | 2381 |
| C2_6 | 20 | 2.40 | | | | |
| C2_7 | 24 | 2.45 | | | | |
| C2_8 | 28 | 2.34 | 27 | 2.397 | 1172 | 2388 |

| BIGO I-III (989 m) | Time syringes (h) | TA corrected (mM) | Time tubes (h) | TA (mM) | $pCO_2$ (ppm) | DIC (µM) |
|---|---|---|---|---|---|---|
| C1_1 | 0.25 | 2.32 | 0.5 | 2.357 | 1035 | 2336 |
| C1_2 | 4 | 2.42 | | | | |
| C1_3 | 8 | 2.37 | 9 | 2.357 | 1077 | 2341 |
| C1_4 | 12 | 2.34 | | | | |
| C1_5 | 16 | 2.32 | 18 | 2.357 | 1068 | 2340 |
| C1_6 | 20 | 2.37 | | | | |
| C1_7 | 24 | 2.40 | | | | |
| C1_8 | 28 | 2.33 | 27 | 2.357 | 1091 | 2343 |
| C2_1 | 0.25 | 2.31 | 0.5 | 2.357 | 1039 | 2337 |
| C2_2 | 4 | 2.34 | | | | |
| C2_3 | 8 | 2.32 | 9 | 2.357 | 1056 | 2339 |
| C2_4 | 12 | 2.37 | | | | |
| C2_5 | 16 | 2.36 | 18 | 2.357 | 1063 | 2340 |
| C2_6 | 20 | 2.36 | | | | |
| C2_7 | 24 | 2.44 | | | | |
| C2_8 | 28 | 2.39 | 27 | 2.357 | 1081 | 2342 |

Table S2. Parameters and boundary conditions for simulating $^{210}Pb_{xs}$.

| Description | St. 1 (74 m) | St. 2 (101 m) | St. 3 (128 m) | St. 4 [a] (142 m) | St. 5 (195 m) | St. 6 (244 m) | St. 7 (306 m) | St. 8 (409 m) | St. 9 (756 m) | St. 10 (989 m) |
|---|---|---|---|---|---|---|---|---|---|---|
| Dry sediment density, $\rho$ (g cm$^{-3}$) | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Porosity at sediment surface (0 cm), $\varphi(0)$ (–) | 0.93 | 0.95 | 0.95 | 0.96 | 0.96 | 0.95 | 0.95 | 0.92 | 0.86 | 0.76 |
| Porosity at sediment base ($L$ cm), $\varphi(L)$ (–) | 0.80 | 0.90 | 0.88 | – | 0.84 | 0.87 | 0.85 | 0.80 | 0.63 | 0.55 |
| Porosity attenuation length, $z_{por}$ (cm) | 0.03 | 0.1 | 0.10 | – | 0.04 | 0.03 | 0.03 | 0.90 | 0.30 | 0.50 |
| Sediment accumulation rate, $\omega_{acc}$ (cm yr$^{-1}$) | 0.45 | No $^{210}Pb_{xs}$ data | 0.2 | 0.04 | 0.10 | No $^{210}Pb_{xs}$ data | 0.05 | 0.011 | 0.035 | 0.06 |
| Bioturbation coefficient at sediment surface, $D_B(0)$ (cm$^2$ yr$^{-1}$) | 1.0 | | 4.0 | 2.0 | 1.0 | | 0.5 | 0.05 | 0.1 | 0.1 |
| Bioturbation halving depth, $x_s$ (cm) | 3.0 | | 3.0 | 1.4 | 2.0 | | 1.4 | 1.4 | 1.4 | 1.4 |
| Flux of $^{210}Pb_{xs}$ to the sediment surface, F(0) (Bq cm$^{-2}$ yr$^{-1}$) | 0.11 | | 0.088 | 0.019 | 0.026 | | 0.023 | 0.0016 | 0.025 | 0.015 |

[a] Porosity at St. 4 (Figure S1) was better simulated using the function: $\varphi(x) = \varphi(0)\cdot\exp(-\frac{x^2}{1200})$