**Supplementary Material**

Figures

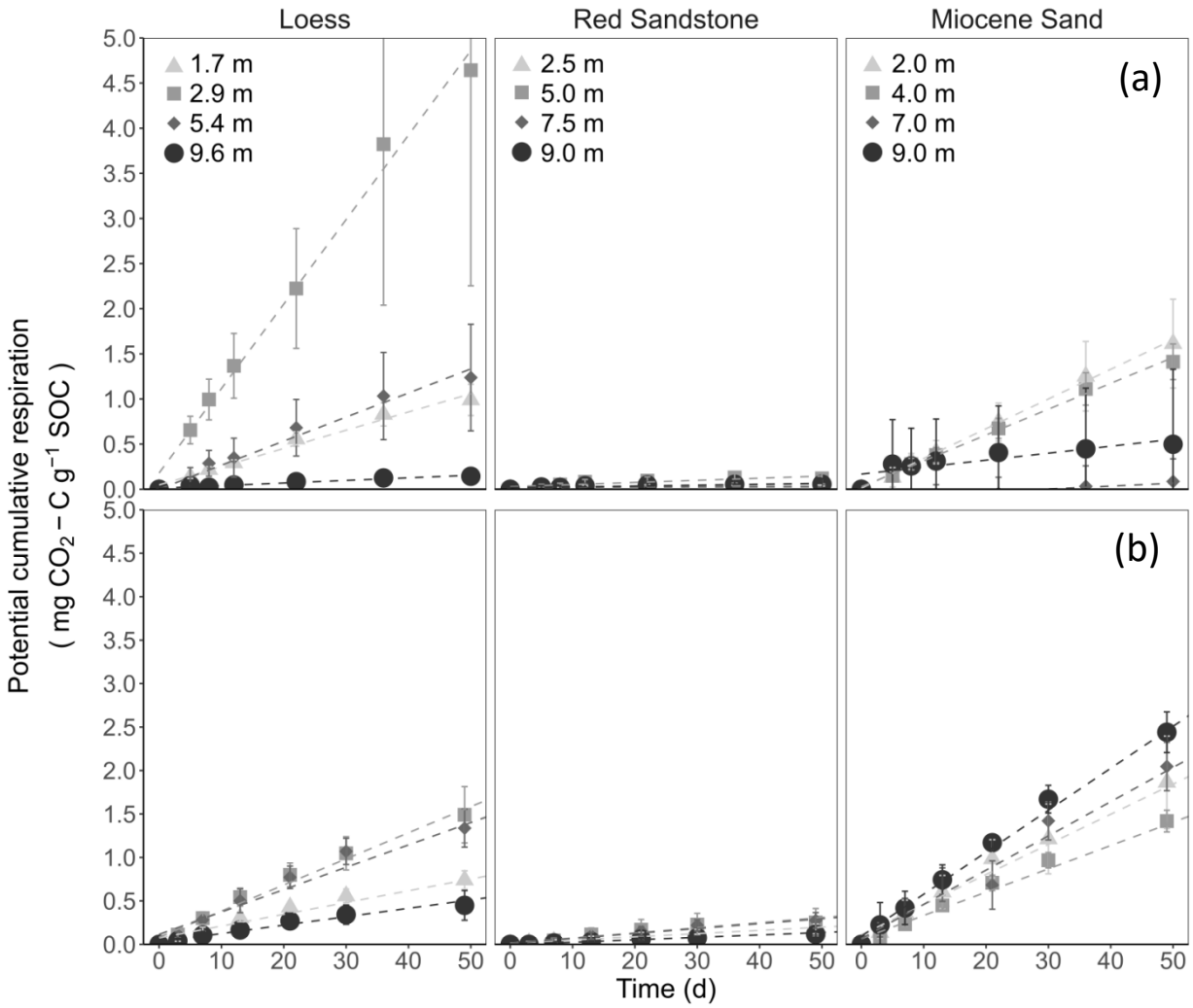


**Figure S1**: Potential degradability of sedimentary OC from three sites during the first incubation experiment (a) and the second incubation experiment with crushed Red Sandstone samples (b). Results represent cumulative respiration at 20°C with respective standard deviations (n = 4). Dashed lines represent a fitted linear model to the respiration data.

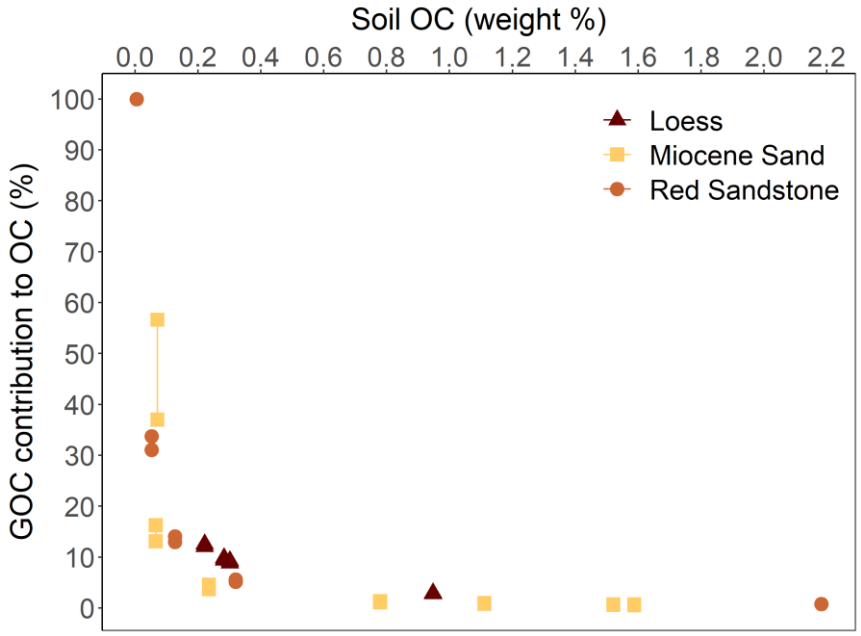


**Figure S2:** Relation between the GOC contribution and the soil OC content.

13 Tables

14 **Table S1:** Selected chemical properties for the soil and sedimentary samples. Values for organic carbon (OC), inorganic
15 carbon (IC) and nitrogen (N) in the sediment (depth ≥ 1.9m) are mean values derived from two cores except for the Loess
16 were only one deep drilling core could be analysed. Soil values (depth ≤ 1.9 m) represent values from one single
17 measurement. The fraction of modern carbon ($F^{14}C$) and respective $^{14}C$ ages were derived only from one sample and thus
18 only from one deep drilling core.

| Substrate | Depth (m) | OC (g $kg^{-1}$) | IC (g $kg^{-1}$) | N (g $kg^{-1}$) | $^{14}C$ age (yrs BP) | $F^{14}C$ |
|---|---|---|---|---|---|---|
| Loess | 0.21 | 9.47 | 0.31 | 0.8 | 0 | 1.029 |
| | 0.54 | 2.83 | 0.30 | 0.24 | - | - |
| | 0.74 | 2.21 | 0.53 | 0.26 | 4,413 | 0.577 |
| | 0.94 | 3.01 | 0.10 | 0.29 | - | - |
| | 1.9 | 2.86 | 0.18 | 3.06 | 2,200 | 0.760 |
| | 2.9 | 2.62 | 0.14 | 0.31 | 2,730 | 0.712 |
| | 3.9 | 9.71 | 0.41 | 0.68 | 2,770 | 0.708 |
| | 4.9 | 1.60 | 9.36 | 0.17 | 13,870 | 0.178 |
| | 5.9 | 0.25 | 0.10 | 0.12 | 14,720 | 0.160 |
| | 6.9 | 0.24 | 0.09 | 0.12 | 17,610 | 0.112 |
| | 7.9 | 0.21 | 0.10 | 0.11 | 30,730 | 0.022 |
| | 8.9 | 0.38 | 0.12 | 0.18 | 20,410 | 0.079 |
| | 9.9 | 0.81 | 10.72 | 0.18 | 18,030 | 0.106 |
| Miocene | 0.03 | 15.87 | - | - | - | - |
| | 0.17 | 11.11 | - | - | - | - |
| | 0.39 | 15.21 | - | - | 1,277 | 0.853 |
| | 0.61 | 7.79 | - | - | 1,771 | 0.802 |
| | 0.81 | 2.35 | - | - | - | - |
| | 1 | 0.66 | - | - | - | - |
| | 1.9 | 0.61 | 0.01 | 0.03 | 7,710 | 0.383 |
| | 2.9 | 0.18 | 0.02 | 0.01 | - | - |
| | 3.9 | 0.30 | 0.01 | 0.02 | - | - |
| | 4.9 | 0.33 | 0.01 | 0.03 | 6,750 | 0.432 |
| | 5.9 | 0.31 | 0.01 | 0.03 | - | - |
| | 6.9 | 0.19 | 0.01 | 0.02 | - | - |
| | 7.9 | 0.14 | 0.00 | 0.02 | 12,770 | 0.204 |
| | 8.9 | 0.16 | 0.00 | 0.02 | - | - |
| | 9.9 | 0.07 | 0.00 | 0.01 | - | - |
| Red | 0.03 | 21.82 | - | - | 0 | 1.035 |
| | 0.29 | 3.2 | - | - | 532 | 0.936 |
| | 0.6 | 1.27 | - | - | - | - |
| | 0.74 | 0.53 | - | - | - | - |
| | 0.9 | 0.05 | - | - | - | - |
| | 1.9 | 0.03 | 0.07 | 0.26 | 13,650 | 0.027 |
| | 2.9 | 0.03 | 4.15 | 0.05 | - | - |
| | 3.9 | 0.04 | 11.10 | 0.01 | - | - |
| | 4.9 | 0.01 | 0.23 | 0.04 | 13,870 | 0.138 |
| | 5.9 | 0.01 | 1.35 | 0.04 | - | - |

| | | | | | |
|---|---|---|---|---|---|
| 6.9 | 0.01 | 1.48 | 0.03 | 12,940 | 0.212 |
| 7.9 | 0.01 | 3.33 | 0.03 | - | - |
| 8.9 | 0.03 | 2.77 | 0.09 | 17,390 | 0.193 |
| 9.9 | 0.02 | 0.85 | 0.10 | - | - |

**Table S2:** Comparison of mineralisation rate constants between the first and the second incubation experiment calculated with linear models. For the fitted linear model the last sampling after 533 days from the second incubation experiment was excluded to compare the incubations under similar conditions.

| Substrate | Depth (m) | 1. Incubation | 2. Incubation | Difference |
|---|---|---|---|---|
| | | Mineralisation rate constant (mg $CO_2$-C $g^{-1}$ OC $y^{-1}$) | | |
| Miocene Sand | 2 | 12.0 | 12.6 | 0.6 |
| | 4 | 10.5 | 9.8 | -0.7 |
| | 7 | 1.2 | 14.4 | 13.2 |
| | 9 | 2.8 | 17.6 | 14.8 |
| Loess | 1.7 | 7.4 | 4.9 | -2.4 |
| | 2.9 | 34.2 | 11.0 | -23.1 |
| | 5.4 | 9.7 | 9.4 | -0.3 |
| | 9.6 | 1.0 | 3.5 | 2.5 |
| Red Sandstone | 2.5 | 0.3 | 1.3 | 1.1 |
| | 5 | 0.9 | 2.2 | 1.3 |
| | 7.5 | 0.03 | 2.1 | 2.0 |
| | 9 | 0.4 | 1.0 | 0.7 |