

Table S1. Summary of depth weighted average soil properties for sampled locations.

| | Depth (m) | pH 1:1 H ₂ O | Clay (%) | Amorphous ² (%) | Al _p (g kg ⁻¹) | Al _o (g kg ⁻¹) | Fe _o (g kg ⁻¹) | Fe _d (g kg ⁻¹) | Fe _o /Fe _d |
|-----------------------------|--------------|-------------------------|-------------|-------------------------------|--|--|--|--|----------------------------------|
| Parent Material x Ecosystem | | | | | | | | | |
| ANpp | 0.96 | 6.1 | 374 | 393 | 2.6 | 10.0 | 4.5 | 48.5 | 0.09 |
| BSpp | 0.80 | 5.9 | 415 | 212 | 2.8 | 5.8 | 2.0 | 54.0 | 0.04 |
| GRpp | 0.92 | 5.3 | 215 | 69 | 0.5 | 0.9 | 0.8 | 11.8 | 0.08 |
| ANwf | 0.86 | 6.0 | 60 | 469 | 6.3 | 35.8 | 6.6 | 14.8 | 0.44 |
| BSwf | 0.92 | 6.3 | 81 | 466 | 2.8 | 24.8 | 2.7 | 13.6 | 0.21 |
| GRwf | 1.09 | 5.9 | 71 | 77 | 1.7 | 3.8 | 2.5 | 4.3 | 0.57 |
| ANrf | 0.76 | 5.8 | 71 | 251 | 5.3 | 31.0 | 5.7 | 10.8 | 0.53 |
| BSrf | 0.95 | 6.1 | 57 | 339 | 2.6 | 13.4 | 3.3 | 9.1 | 0.38 |
| GRrf | 0.97 | 5.2 | 39 | 55 | 2.3 | 4.4 | 1.7 | 2.6 | 0.67 |

Table S2. Summary of radiocarbon data for all composited bulk and fraction samples ¹⁻⁵.

| Parent Material | Ecosystem | Top Depth (cm) | Bottom Depth (cm) | CAMS # | Sample | fraction | ± | Δ14C | ± | 14C age | ± |
|-----------------|-----------|----------------|-------------------|--------|--------------|----------|-------|----------|-------|---------|----|
| AN | PP | 0 | 6 | 165637 | AN PP 1 | 1.128 | 0.004 | 119.095 | 3.964 | >modern | |
| AN | PP | 6 | 18 | 165638 | AN PP 2 | 0.986 | 0.004 | -21.391 | 3.617 | 110 | 30 |
| AN | PP | 18 | 45 | 165639 | AN PP 3 | 0.961 | 0.003 | -46.509 | 3.411 | 320 | 30 |
| AN | PP | 45 | 70 | 165640 | AN PP 4 | 0.806 | 0.003 | -199.970 | 2.837 | 1730 | 30 |
| AN | PP | 70 | 96 | 165641 | AN PP 5 | 0.846 | 0.003 | -160.937 | 2.802 | 1345 | 30 |
| AN | RF | 0 | 4 | 165642 | AN RF 1 | 1.085 | 0.004 | 76.265 | 3.812 | >modern | |
| AN | RF | 4 | 9 | 166233 | AN RF 2 4-9 | 1.085 | 0.004 | 76.404 | 4.115 | >modern | |
| AN | RF | 9 | 22 | 166234 | AN RF 2 9-22 | 0.971 | 0.004 | -36.870 | 3.659 | 240 | 35 |
| AN | RF | 22 | 43 | 165643 | AN RF 3 | 0.957 | 0.003 | -50.447 | 3.368 | 355 | 30 |
| AN | RF | 43 | 67 | 165644 | AN RF 4 | 0.939 | 0.003 | -68.155 | 3.308 | 505 | 30 |
| AN | RF | 67 | 80 | 165645 | AN RF 5 | 0.910 | 0.003 | -97.052 | 3.204 | 760 | 30 |
| AN | WF | 0 | 10 | 165646 | AN WF 1 | 1.016 | 0.004 | 8.457 | 3.578 | >modern | |
| AN | WF | 10 | 21 | 166422 | AN WF 2 | 0.970 | 0.004 | -37.638 | 3.824 | 245 | 35 |
| AN | WF | 21 | 52 | 165648 | AN WF 3 | 0.958 | 0.003 | -49.670 | 3.372 | 345 | 30 |
| AN | WF | 52 | 78 | 165647 | AN WF 4 | 0.911 | 0.003 | -95.583 | 3.211 | 745 | 30 |
| AN | WF | 78 | 85 | 166232 | ANWF 5 | 0.786 | 0.003 | -220.509 | 2.898 | 1940 | 30 |
| BS | PP | 0 | 10 | 165649 | BS PP 1 | 1.081 | 0.004 | 72.990 | 3.807 | >modern | |
| BS | PP | 10 | 31 | 165650 | BS PP 2 | 1.047 | 0.004 | 38.449 | 3.698 | >modern | |
| BS | PP | 31 | 56 | 165651 | BS PP 3 | 0.917 | 0.003 | -89.721 | 3.243 | 695 | 30 |
| BS | PP | 56 | 83 | 165652 | BS PP 4 | 0.929 | 0.003 | -78.322 | 3.283 | 595 | 30 |
| BS | RF | 0 | 9 | 166401 | BS RF 1 | 1.016 | 0.004 | 7.805 | 3.602 | >modern | |
| BS | RF | 9 | 23 | 166235 | BS RF 2 | 0.981 | 0.004 | -26.734 | 4.284 | 155 | 40 |
| BS | RF | 23 | 63 | 166236 | BS RF 3 | 0.922 | 0.004 | -85.264 | 3.787 | 655 | 35 |
| BS | RF | 63 | 98 | 166237 | BS RF 4 | 0.937 | 0.003 | -70.662 | 3.415 | 525 | 30 |
| BS | WF | 0 | 8 | 166238 | BS WF 1 | 1.092 | 0.004 | 83.422 | 3.893 | >modern | |
| BS | WF | 8 | 38 | 166239 | BS WF 2 | 1.054 | 0.004 | 45.513 | 3.790 | >modern | |
| BS | WF | 38 | 56 | 166240 | BS WF 3 | 0.933 | 0.004 | -73.798 | 4.332 | 555 | 40 |
| BS | WF | 56 | 90 | 166241 | BS WF 4 | 0.892 | 0.004 | -115.085 | 4.052 | 920 | 40 |
| GR | PP | 0 | 10 | 166242 | GR PP 1 | 1.084 | 0.004 | 75.179 | 4.292 | >modern | |
| GR | PP | 10 | 37 | 166243 | GR PP 2 | 1.019 | 0.004 | 10.679 | 3.990 | >modern | |
| GR | PP | 37 | 84 | 166672 | GR PP 3 | 1.006 | 0.004 | -2.300 | 3.500 | >modern | |
| GR | PP | 84 | 94 | 166244 | GR PP 4 | 0.842 | 0.003 | -164.239 | 3.025 | 1380 | 30 |
| GR | RF | 0 | 13 | 166245 | GR RF 1 | 1.044 | 0.004 | 35.651 | 4.380 | >modern | |
| GR | RF | 13 | 34 | 166246 | GR RF 2 | 1.029 | 0.004 | 20.616 | 4.213 | >modern | |
| GR | RF | 34 | 62 | 166247 | GR RF 3 | 0.922 | 0.004 | -85.365 | 3.543 | 655 | 35 |
| GR | RF | 62 | 77 | 166248 | GR RF 4 | 0.904 | 0.003 | -102.985 | 3.262 | 810 | 30 |
| GR | RF | 77 | 98 | 166249 | GR RF 5 | 0.887 | 0.003 | -119.607 | 3.476 | 960 | 35 |
| GR | WF | 0 | 9 | 166250 | GR WF 1 | 1.086 | 0.005 | 77.985 | 5.102 | >modern | |

| | | | | | | | | | | | |
|----|----|----|-----|--------|--------------|-------|-------|----------|-------|---------|----|
| GR | WF | 9 | 26 | 166251 | GR WF 2 | 1.018 | 0.004 | 9.811 | 4.031 | >modern | |
| GR | WF | 26 | 77 | 166252 | GR WF 3 | 0.957 | 0.003 | -50.382 | 3.462 | 355 | 30 |
| GR | WF | 77 | 94 | 166253 | GR WF 4 | 0.883 | 0.003 | -123.434 | 3.206 | 995 | 30 |
| GR | WF | 94 | 114 | 166254 | GR WF 5 | 0.885 | 0.003 | -121.564 | 3.202 | 980 | 30 |
| AN | PP | 0 | 6 | 166402 | AN.PP.A.bulk | 1.131 | 0.004 | 121.890 | 4.033 | >modern | |
| AN | PP | 0 | 6 | 166403 | AN.PP.A.flf | 1.162 | 0.004 | 152.664 | 4.140 | >modern | |
| AN | PP | 0 | 6 | 166404 | AN.PP.A.occ | 1.069 | 0.004 | 60.504 | 3.811 | >modern | |
| AN | PP | 0 | 6 | 166405 | AN.PP.A.min | 1.082 | 0.004 | 73.307 | 3.855 | >modern | |
| AN | PP | 18 | 45 | 166406 | AN.PP.B.bulk | 0.934 | 0.003 | -73.138 | 3.334 | 550 | 30 |
| AN | PP | 18 | 45 | 166407 | AN.PP.B.flf | 0.981 | 0.003 | -26.544 | 3.226 | 155 | 30 |
| AN | PP | 18 | 45 | 166408 | AN.PP.B.occ | 0.876 | 0.003 | -130.453 | 3.128 | 1060 | 30 |
| AN | PP | 18 | 45 | 166409 | AN.PP.B.min | 0.939 | 0.003 | -68.186 | 3.350 | 505 | 30 |
| AN | RF | 0 | 4 | 166410 | AN.RF.A.bulk | 1.068 | 0.004 | 60.113 | 4.453 | >modern | |
| AN | RF | 0 | 4 | 166411 | AN.RF.A.flf | 1.080 | 0.004 | 71.626 | 3.851 | >modern | |
| AN | RF | 0 | 4 | 166412 | AN.RF.A.occ | 0.976 | 0.004 | -31.802 | 3.655 | 195 | 35 |
| AN | RF | 0 | 4 | 166413 | AN.RF.A.min | 1.033 | 0.004 | 24.928 | 3.681 | >modern | |
| AN | RF | 22 | 43 | 166414 | AN.RF.B.bulk | 0.957 | 0.004 | -49.903 | 4.234 | 350 | 40 |
| AN | RF | 22 | 43 | 166415 | AN.RF.B.flf | 0.974 | 0.003 | -33.626 | 3.459 | 215 | 30 |
| AN | RF | 22 | 43 | 166416 | AN.RF.B.occ | 0.866 | 0.003 | -140.241 | 3.089 | 1150 | 30 |
| AN | RF | 22 | 43 | 166417 | AN.RF.B.min | 0.931 | 0.003 | -76.671 | 3.309 | 580 | 30 |
| AN | WF | 0 | 10 | 166418 | AN.WF.A.bulk | 1.025 | 0.004 | 16.841 | 3.639 | >modern | |
| AN | WF | 0 | 10 | 166419 | AN.WF.A.flf | 1.022 | 0.004 | 14.409 | 3.630 | >modern | |
| AN | WF | 0 | 10 | 166420 | AN.WF.A.occ | 0.948 | 0.003 | -59.251 | 3.368 | 430 | 30 |
| AN | WF | 0 | 10 | 166421 | AN.WF.A.min | 1.003 | 0.004 | -5.227 | 3.560 | modern | |
| AN | WF | 10 | 21 | 166422 | AN.WF.B.bulk | 0.970 | 0.004 | -37.638 | 3.824 | 245 | 35 |
| AN | WF | 10 | 21 | 166423 | AN.WF.B.flf | 0.964 | 0.003 | -43.217 | 3.420 | 295 | 30 |
| AN | WF | 10 | 21 | 166424 | AN.WF.B.occ | 0.894 | 0.003 | -113.332 | 3.184 | 905 | 30 |
| AN | WF | 10 | 21 | 166425 | AN.WF.B.min | 0.952 | 0.003 | -55.384 | 3.379 | 395 | 30 |
| BS | PP | 0 | 10 | 166426 | BS.PP.A.bulk | 1.085 | 0.004 | 76.656 | 3.848 | >modern | |
| BS | PP | 0 | 10 | 166427 | BS.PP.A.flf | 1.129 | 0.004 | 120.635 | 4.003 | >modern | |
| BS | PP | 0 | 10 | 166428 | BS.PP.A.occ | 1.058 | 0.004 | 49.634 | 4.317 | >modern | |
| BS | PP | 0 | 10 | 166429 | BS.PP.A.min | 1.034 | 0.004 | 25.760 | 3.666 | | |
| BS | PP | 31 | 56 | 166430 | BS.PP.B.bulk | 0.940 | 0.003 | -67.326 | 3.314 | 500 | 30 |
| BS | PP | 31 | 56 | 166431 | BS.PP.B.flf | 1.002 | 0.004 | -5.936 | 3.528 | modern | |
| BS | PP | 31 | 56 | 166432 | BS.PP.B.occ | 0.899 | 0.004 | -108.164 | 3.600 | 855 | 35 |
| BS | PP | 31 | 56 | 166433 | BS.PP.B.min | 0.889 | 0.004 | -118.184 | 3.879 | 950 | 40 |
| BS | RF | 0 | 9 | 166642 | BS.RF.A.bulk | 1.035 | 0.004 | 27.292 | 3.644 | >modern | |
| BS | RF | 0 | 9 | 166643 | BS.RF.A.flf | 1.056 | 0.004 | 47.755 | 4.399 | >modern | |
| BS | RF | 0 | 9 | 166644 | BS.RF.A.occ | 0.995 | 0.003 | -12.438 | 3.492 | 40 | 30 |
| BS | RF | 0 | 9 | 166645 | BS.RF.A.min | 0.997 | 0.004 | -10.223 | 3.501 | 20 | 30 |
| BS | RF | 23 | 63 | 166638 | BS.RF.B.bulk | 0.938 | 0.003 | -68.758 | 3.362 | 510 | 30 |
| BS | RF | 23 | 63 | 166639 | BS.RF.B.flf | 0.976 | 0.003 | -31.066 | 3.438 | 190 | 30 |
| BS | RF | 23 | 63 | 166640 | BS.RF.B.occ | 0.803 | 0.003 | -203.502 | 3.021 | 1765 | 35 |

| | | | | | | | | | | | |
|----|----|----|----|--------|--------------|-------|-------|----------|-------|---------|----|
| BS | RF | 23 | 63 | 166641 | BS.RF.B.min | 0.915 | 0.003 | -91.833 | 3.223 | 710 | 30 |
| BS | WF | 0 | 8 | 166646 | BS.WF.A.bulk | 1.081 | 0.004 | 72.799 | 3.791 | >modern | |
| BS | WF | 0 | 8 | 166647 | BS.WF.A.flf | 1.058 | 0.004 | 49.435 | 3.711 | >modern | |
| BS | WF | 0 | 8 | 166648 | BS.WF.A.occ | 0.953 | 0.003 | -54.473 | 3.344 | 390 | 30 |
| BS | WF | 0 | 8 | 166649 | BS.WF.A.min | 1.068 | 0.004 | 59.354 | 3.746 | >modern | |
| BS | WF | 8 | 38 | 166650 | BS.WF.B.bulk | 1.030 | 0.003 | 22.507 | 3.438 | >modern | |
| BS | WF | 8 | 38 | 166651 | BS.WF.B.flf | 1.041 | 0.004 | 32.521 | 3.659 | >modern | |
| BS | WF | 8 | 38 | 166652 | BS.WF.B.occ | 0.883 | 0.003 | -123.393 | 3.166 | 995 | 30 |
| BS | WF | 8 | 38 | 166653 | BS.WF.B.min | 1.006 | 0.005 | -1.764 | 4.594 | modern | |
| GR | PP | 0 | 10 | 166654 | GR.PP.A.bulk | 1.055 | 0.004 | 47.194 | 3.710 | >modern | |
| GR | PP | 0 | 10 | 166655 | GR.PP.A.flf | 1.087 | 0.004 | 79.063 | 3.822 | >modern | |
| GR | PP | 0 | 10 | 166656 | GR.PP.A.occ | 1.017 | 0.004 | 9.424 | 3.575 | >modern | |
| GR | PP | 0 | 10 | 166657 | GR.PP.A.min | 1.031 | 0.004 | 23.531 | 3.627 | >modern | |
| GR | PP | 37 | 84 | 166671 | GR.PP.B.bulk | 0.948 | 0.004 | -59.250 | 3.875 | 430 | 35 |
| GR | PP | 37 | 84 | 166658 | GR.PP.B.flf | 1.041 | 0.004 | 32.846 | 3.659 | >modern | |
| GR | PP | 37 | 84 | 166659 | GR.PP.B.occ | 0.848 | 0.003 | -159.020 | 3.237 | 1330 | 35 |
| GR | PP | 37 | 84 | 166660 | GR.PP.B.min | 0.840 | 0.003 | -166.575 | 3.144 | 1400 | 35 |
| GR | RF | 0 | 13 | 166661 | GR.RF.A.bulk | 1.062 | 0.004 | 53.979 | 3.733 | >modern | |
| GR | RF | 0 | 13 | 166662 | GR.RF.A.flf | 1.071 | 0.004 | 62.565 | 4.432 | >modern | |
| GR | RF | 0 | 13 | 166663 | GR.RF.A.occ | 0.994 | 0.003 | -13.848 | 3.493 | 50 | 30 |
| GR | RF | 0 | 13 | 166664 | GR.RF.A.min | 0.997 | 0.003 | -10.851 | 3.480 | 25 | 30 |
| GR | RF | 13 | 34 | 167028 | GR.RF.B.bulk | 1.047 | 0.004 | 38.770 | 3.709 | >modern | |
| GR | RF | 13 | 34 | 166665 | GR.RF.B.flf | 1.056 | 0.004 | 47.439 | 3.971 | >modern | |
| GR | RF | 13 | 34 | | GR.RF.B.occ | | | NO DATA | | | |
| GR | RF | 13 | 34 | 166666 | GR.RF.B.min | 0.975 | 0.003 | -32.439 | 3.403 | 205 | 30 |
| GR | WF | 0 | 9 | 166667 | GR.WF.A.bulk | 1.055 | 0.004 | 46.514 | 4.406 | >modern | |
| GR | WF | 0 | 9 | 166668 | GR.WF.A.flf | 1.032 | 0.004 | 23.802 | 3.734 | >modern | |
| GR | WF | 0 | 9 | 166669 | GR.WF.A.occ | 0.983 | 0.004 | -25.016 | 3.684 | 140 | 35 |
| GR | WF | 0 | 9 | 166670 | GR.WF.A.min | 1.016 | 0.005 | 8.591 | 5.075 | >modern | |
| GR | WF | 26 | 77 | 166673 | GR.WF.B.bulk | 0.960 | 0.003 | -47.184 | 3.349 | 325 | 30 |
| GR | WF | 26 | 77 | 166674 | GR.WF.B.flf | 0.938 | 0.003 | -69.613 | 3.273 | 515 | 30 |
| GR | WF | 26 | 77 | 166675 | GR.WF.B.occ | 0.849 | 0.003 | -157.759 | 2.967 | 1315 | 30 |
| GR | WF | 26 | 77 | 166676 | GR.WF.B.min | 0.928 | 0.003 | -78.941 | 3.241 | 600 | 30 |

¹ The quoted age is in radiocarbon years using the Libby half-life of 5568 years and following the conventions of Stuiver and Polach (Radiocarbon, v. 19, p.355, 1977). Estimated $\delta^{13}C$ values provided by the submitter were used for fractionation corrections according to Stuiver and Pollach (ibid.); ² Radiocarbon concentration is given as fraction Modern, $\Delta^{14}C$, and conventional radiocarbon age; ³ Sample preparation backgrounds have been subtracted, based on measurements of ^{14}C -free coal; ⁴ Samples were graphitized in the Houghton Carbon, Water and Soils Lab, USDA-FS Northern Research Station; ⁵ Radiocarbon measurements were conducted at the Center for Accelerator Mass Spectrometry, Lawrence Livermore National Lab.

Table S3. Summary of average (± 1 standard error) density fraction mass and C partitioning and radiocarbon content for surface and subsurface horizons.

| | C (g kg ⁻¹ fraction) | | | C:N | | | C Partitioning (% of Total C) | | | Δ14C (‰) | | |
|-------------------|------------------------------------|----------------|--------------|----------------|--------------------|---------------|----------------------------------|---------------|----------------|-------------|--------|------------|
| | fLF | oLF | MF | fLF | oLF | MF | fLF | oLF | MF | fLF | oLF | MF |
| <u>Surface</u> | | | | | | | | | | | | |
| ANpp | 313 ± 14 A | 322 ± 49 A | 33 ± 5 A | 35.6 ± 1.5 AB | 49.9 ± 9.9 A | 16.8 ± 0.3 A | 34.6 ± 4.3 C | 26.3 ± 3.2 A | 39.1 ± 4.5 AB | 152.7 | 60.5 | 73.3 |
| BSpp | 299 ± 6 A | 411 ± 4 A | 29 ± 4 AB | 35.4 ± 1.3 AB | 38.7 ± 2.5 A | 15.9 ± 0.1 AB | 46.3 ± 15.0 ABC | 17.4 ± 1.9 AB | 36.3 ± 16.4 AB | 120.6 | 49.6 | 25.8 |
| GRpp | 319 ± 6 A | 448 ± 2 A | 18 ± 3 BC | 40.6 ± 2.1 A | 47.3 ± 1.3 A | 19.0 ± 0.8 A | 43.9 ± 4.7 BC | 26.0 ± 1.8 A | 30.1 ± 3.4 AB | 79.1 | 9.4 | 23.5 |
| ANwf | 204 ± 17 B | 396 ± 18 A | 35 ± 3 A | 26.5 ± 1.3 AB | 42.4 ± 7.9 A | 16.4 ± 0.4 AB | 37.8 ± 4.9 BC | 2.3 ± 0.1 C | 59.9 ± 5.0 A | 14.4 | -59.3 | -5.2 |
| BSwf | 209 ± 31 B | 392 ± 5 A | 13 ± 1 C | 39.7 ± 5.2 A | 41.6 ± 5.9 A | 18.7 ± 1.1 A | 79.3 ± 0.9 AB | 8.6 ± 1.1 BC | 12.1 ± 0.3 B | 49.4 | -54.5 | 59.4 |
| GRwf | 317 ± 19 AB | 416 ± 8 A | 10 ± 2 C | 36.1 ± 1.5 AB | 37.3 ± 1.4 A | 15.9 ± 0.9 AB | 67.3 ± 9.1 ABC | 8.2 ± 2.5 BC | 24.5 ± 6.7 AB | 23.8 | -25.0 | 8.6 |
| ANrf | 205 ± 7 B | 368 ± 5 A | 17 ± 1 BC | 35.6 ± 0.4 AB | 34.6 ± 4.8 A | 18.7 ± 0.7 A | 44.9 ± 16.8 BC | 12.2 ± 4.4 BC | 42.9 ± 12.7 AB | 71.6 | -31.8 | 24.9 |
| BSrf | 287 ± 16 AB | 336 ± 26 A | 5 ± 1 C | 24.7 ± 1.4 B | 29.5 ± 9.2 A | 13.5 ± 0.2 B | 88.3 ± 3.2 A | 6.7 ± 1.9 BC | 5.0 ± 1.3 B | 47.8 | -12.4 | -10.2 |
| GRrf | 284 ± 28 AB | 378 ± 72 A | 6 ± 1 C | 36.8 ± 5.9 AB | 52.0 ± 7.6 A | 18.2 ± 0.5 A | 70.7 ± 4.2 ABC | 8.3 ± 1.5 BC | 21.0 ± 2.8 B | 62.6 | -13.9 | -10.9 |
| <u>Subsurface</u> | | | | | | | | | | | | |
| ANpp | 268 ± 2 CDE | 290 ± 70 A | 10 ± 0 BC | 46.4 ± 1.0 BC | 62.9 ± 3.9 ABC | 12.3 ± 0.2 D | 11.7 ± 2.3 D | 7.2 ± 1.8 C | 81.0 ± 1.3 A | -26.5 | -130.5 | -68.2 |
| BSpp | 368 ± 7 AB | 426 ± 1 A | 6 ± 0 CD | 76.6 ± 7.8 A | 69.0 ± 0.8 AB | 12.2 ± 0.4 D | 41.6 ± 1.8 ABC | 25.7 ± 0.9 A | 32.7 ± 1.1 D | -5.9 | -108.2 | - 118.2 |
| GRpp | 390 ± 7 A | 180 ± 120 A | 2 ± 0 D | 65.9 ± 3.1 AB | 58.9 ± 2.2 ABC | 9.0 ± 0.3 E | 37.6 ± 2.5 BC | 3.9 ± 2.4 C | 58.4 ± 4.8 BC | 32.9 | -159.0 | - 166.6 |
| ANwf | 229 ± 13 DEF | 408 ± 24 A | 35 ± 5 A | 28. ± 1.6 C | 45.9 ± 10.0 ABC | 15.2 ± 0.2 BC | 28.5 ± 2.3 CD | 2.2 ± 0.2 C | 69.3 ± 2.5 AB | -43.2 | -113.3 | -55.4 |
| BSwf | 178 ± 8 F | 385 ± 9 A | 12 ± 0 BC | 39.5 ± 2.2 BC | 42.0 ± 2.9 BC | 17.6 ± 0.5 AB | 45.9 ± 4.6 ABC | 24.5 ± 6.5 AB | 29.6 ± 2.4 D | 32.5 | -123.4 | -1.8 |
| GRwf | 281 ± 12 CD | 274 ± 119 A | 5 ± 1 CD | 40.1 ± 5.4 BC | 40.1 ± 5.4 B | 12.8 ± 1.3 CD | 38.0 ± 3.2 BC | 6.3 ± 2.8 C | 55.7 ± 5.6 BC | -69.6 | -157.8 | -78.9 |
| ANrf | 234 ± 7 DEF | 370 ± 6 A | 15 ± 1 B | 40.4 ± 1.9 BC | 37.4 ± 7.0 C | 16.0 ± 0.1 AB | 28.7 ± 6.8 CD | 3.9 ± 1.1 C | 67.5 ± 7.9 AB | -33.6 | -140.2 | -76.7 |
| BSrf | 197 ± 18 EF | 379 ± 18 A | 12 ± 2 BC | 39.1 ± 3.1 BC | 39.2 ± 2.2 C | 16.0 ± 0.3 AB | 49.3 ± 3.0 AB | 11.5 ± 1.8 BC | 39.2 ± 4.0 CD | -31.1 | -203.5 | -91.8 |
| GRrf | 312 ± 31 BC | 454 ± 28 A | 4 ± 0 CD | 44.7 ± 14.3 BC | 71.5 ± 8.7 A | 18.2 ± 0.6 A | 60.2 ± 4.8 A | 6.0 ± 1.0 C | 33.9 ± 3.8 D | 47.4 | N.D. | -32.4 |

Table S4. Spearman's rho correlation matrix of soil carbon and radiocarbon content by depth residuals relative to soil physicochemical properties ¹.

| MAT (°C) | Clay (g kg ⁻¹) | Fed (g kg ⁻¹) | Feo (g kg ⁻¹) | Alo (g kg ⁻¹) | Alp (g kg ⁻¹) | Alo +1/2Feo (g kg ⁻¹) | Feo/Fed | pH H2O | Amorphous (g kg ⁻¹) | Δ14C depth residuals | C depth residuals |
|-------------|-------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|--------------------------------------|---------|-----------|------------------------------------|-------------------------|----------------------|
|-------------|-------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|--------------------------------------|---------|-----------|------------------------------------|-------------------------|----------------------|

| | 1) | 1) | 1) | 1) | | | | | | | | |
|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---|
| MAT | 1 | | | | | | | | | | | |
| Clay | 0.859 | 1 | | | | | | | | | | |
| Fed | 0.797 | 0.750 | 1 | | | | | | | | | |
| Feo | -0.061 | -0.047 | 0.364 | 1 | | | | | | | | |
| Alo | -0.069 | -0.123 | 0.354 | 0.858 | 1 | | | | | | | |
| Alp | -0.116 | -0.191 | 0.194 | 0.749 | 0.824 | 1 | | | | | | |
| Alo +1/2Feo | -0.006 | -0.043 | 0.405 | 0.910 | 0.972 | 0.832 | 1 | | | | | |
| Feo/Fed | -0.862 | -0.828 | -0.803 | 0.127 | 0.076 | 0.210 | 0.046 | 1 | | | | |
| pH H2O | 0.313 | 0.175 | 0.395 | 0.471 | 0.424 | 0.405 | 0.483 | -0.256 | 1 | | | |
| Amorphous | 0.385 | 0.255 | 0.649 | 0.618 | 0.664 | 0.503 | 0.710 | -0.426 | 0.705 | 1 | | |
| $\Delta^{14}\text{C}$ residuals | 0.061 | 0.153 | -0.153 | -0.434 | -0.260 | -0.133 | -0.259 | -0.066 | -0.132 | -0.346 | 1 | |
| C residuals | 0.219 | 0.170 | 0.540 | 0.650 | 0.630 | 0.488 | 0.667 | -0.173 | 0.228 | 0.432 | -0.041 | 1 |

¹Shaded values indicate significant correlations at P < 0.0003 based on Bonferroni correctio.