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Iron-bound organic carbon in forest soils: quantification and characterization

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Table S1 The major data collected in this study for the 14 forest soils

Forest	TC (%)	TOC (%)	$f_{Fe\text{-}OC}$ (%)	Reactive Fe (mg g^{-1})	$\delta^{13}C_{TOC}$	$\delta^{13}C_{non\text{-}Fe\text{-}OC}$	$\delta^{13}C_{Fe\text{-}OC}$	$\delta^{13}C_{Labile}$
				Average Value				
AL	3.34	3.55	5.57	4.87	-27.32	-27.71	-23.42	-30.29
BL	3.15	2.83	12.07	4.13	-26.76	-27.17	-26.50	-26.64
MS	3.99	3.01	13.04	19.31	-27.42	-27.96	-25.18	-23.43
TSI	5.58	4.30	18.16	6.20	-26.09	-26.43	-24.60	-29.04
GS	1.94	1.20	0.00	0.08	-26.93	-26.80	-27.01	-26.85
HT	4.83	3.00	36.67	2.69	-27.28	-27.33	-27.24	-28.53
HL	4.76	3.34	57.75	5.24	-25.87	-26.57	-25.40	-26.69
LV	1.55	1.07	11.96	0.99	-24.93	-25.40	-23.51	-24.27
LVF	1.86	1.36	11.02	2.11	-24.71	-25.59	-23.93	-24.53
NR	3.45	2.83	12.06	1.27	-26.31	-26.48	-26.03	-28.15
OR	2.44	2.31	0.00	1.60	-27.07	-27.66	-24.22	-27.51
TSII	8.30	6.05	7.41	6.87	-25.77	-26.00	-25.13	-26.67
TKF	3.41	2.76	19.99	1.85	-24.54	-25.11	-23.34	-24.08
TK	5.33	5.40	12.62	2.28	-25.29	-25.64	-24.50	-23.58
				Standard Deviation				
AL	0.23	0.30	11.03	1.64	0.30	0.03	1.51	5.28
BL	0.09	0.62	10.66	0.83	0.71	0.32	0.96	1.02
MS	0.56	0.14	3.08	5.56	0.13	0.08	0.14	2.15
TSI	0.58	0.69	0.07	0.60	0.37	0.39	0.39	6.71
GS	0.79	0.38	5.79	0.02	0.09	0.17	0.20	0.05
HT	0.04	0.30	36.87	0.84	0.02	0.04	0.00	1.26
HL	0.57	0.30	23.08	2.65	0.54	0.21	0.68	0.57
LV	0.07	0.00	13.82	0.08	0.23	0.31	0.08	0.37
LVF	0.14	0.15	3.45	1.23	0.03	0.10	0.17	0.16
NR	0.04	0.27	32.26	0.01	0.15	0.04	0.43	1.92
OR	0.02	0.10	6.56	0.03	0.04	0.13	0.16	0.84
TSII	1.49	1.87	14.22	0.79	0.09	0.12	0.17	0.70
TKF	0.67	0.52	10.32	0.51	0.02	0.03	0.05	0.77
TK	0.29	1.51	14.54	0.11	0.29	0.24	0.34	1.71

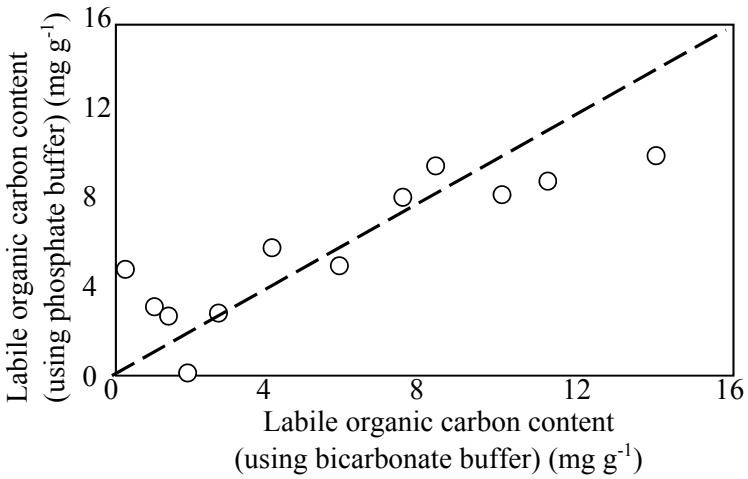


Figure S1. Labile OC under heating extraction was measured by different buffers, bicarbonate buffer and phosphate buffer, with the same ionic strength. Dashed line represented the 1:1 ratio.

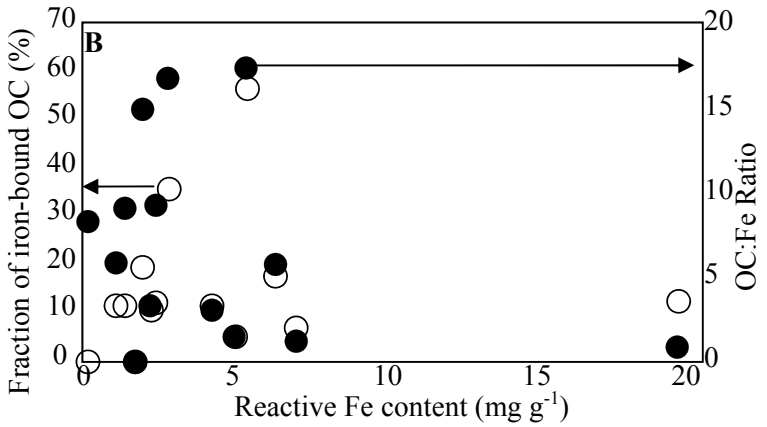
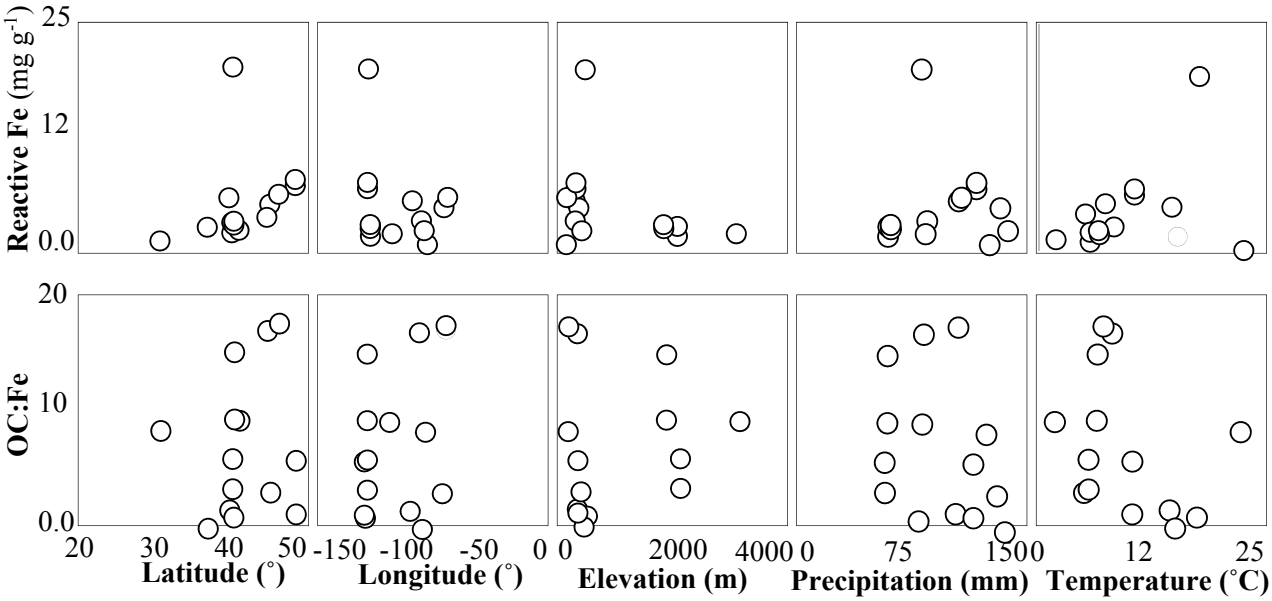


Figure S2. Relationship between the fraction of Fe-bound OC in TOC ($f_{Fe\text{-}OC}$)/ OC:Fe molar ratio and reactive Fe concentration in U.S. forest soils.



71 Figure S3. Correlation between reactive Fe, OC:Fe and ecogeographical parameters including
72 latitude, longitude, elevation (asl), precipitation (mean annual) and temperature (annual mean).

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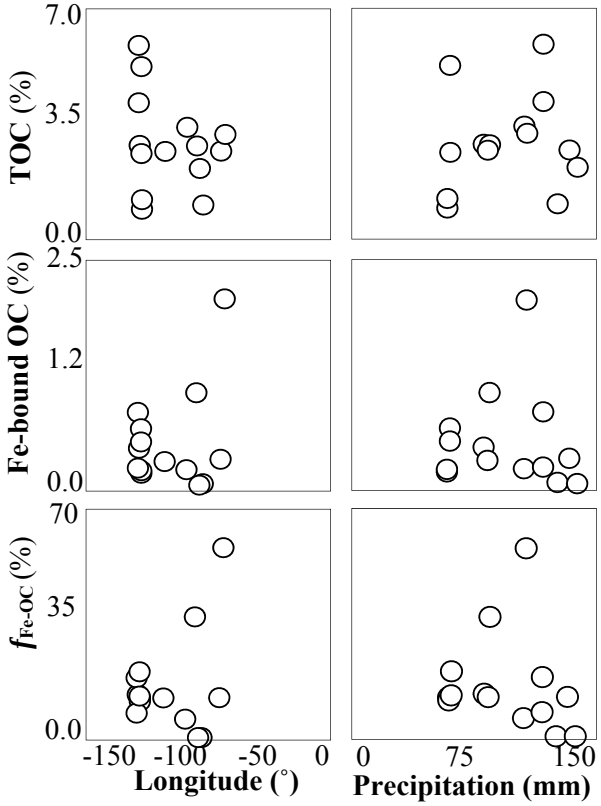

Figure S4. Correlation between TOC, concentration of Fe-bound OC, $f_{Fe\text{-}TOC}$ and ecogeographical parameters including longitude and precipitation (mean annual).

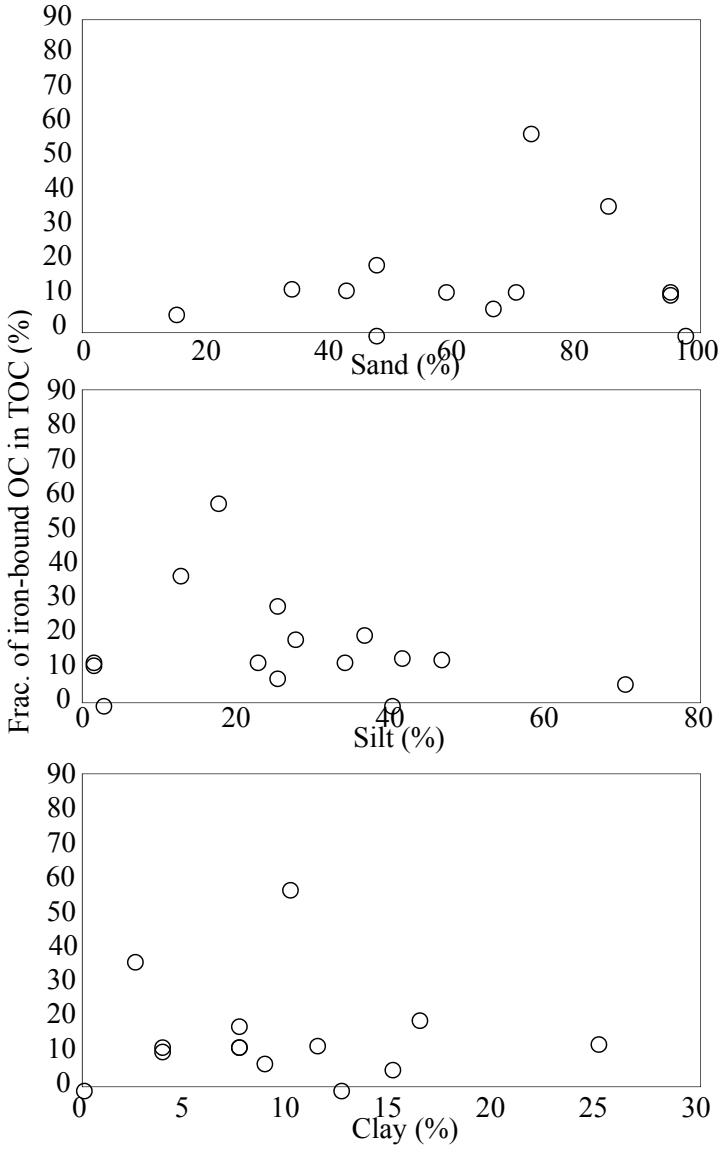

Figure S5. Relationship between the fractions of calibrated iron-bound organic carbon (OC) in total organic carbon (TOC) and soil texture (i.e., fractions of sand, silt, and clay in forest soils).

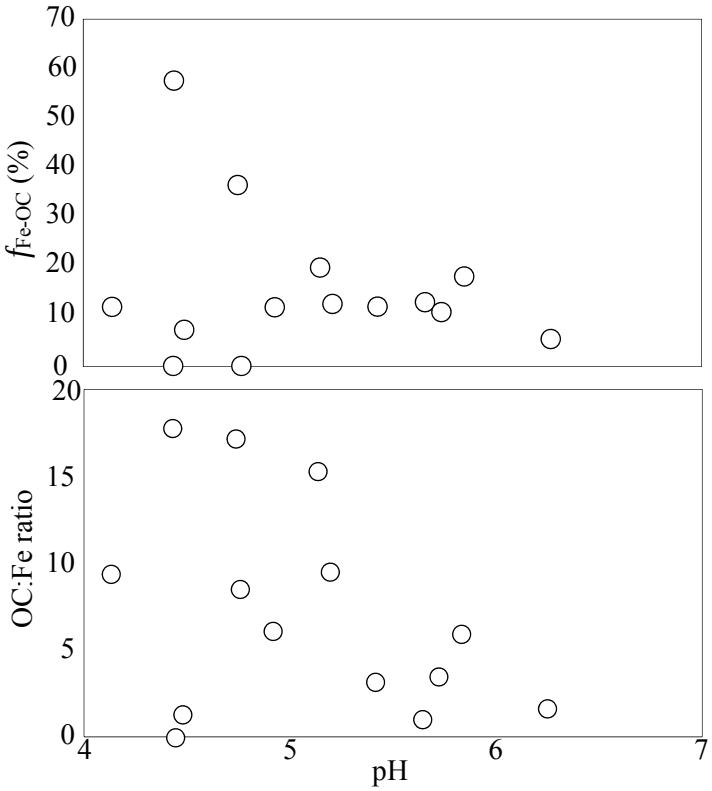

Figure S6. Variation of $f_{Fe\text{-}OC}$ and OC:Fe molar ratio vs. soil pH for forest soils.

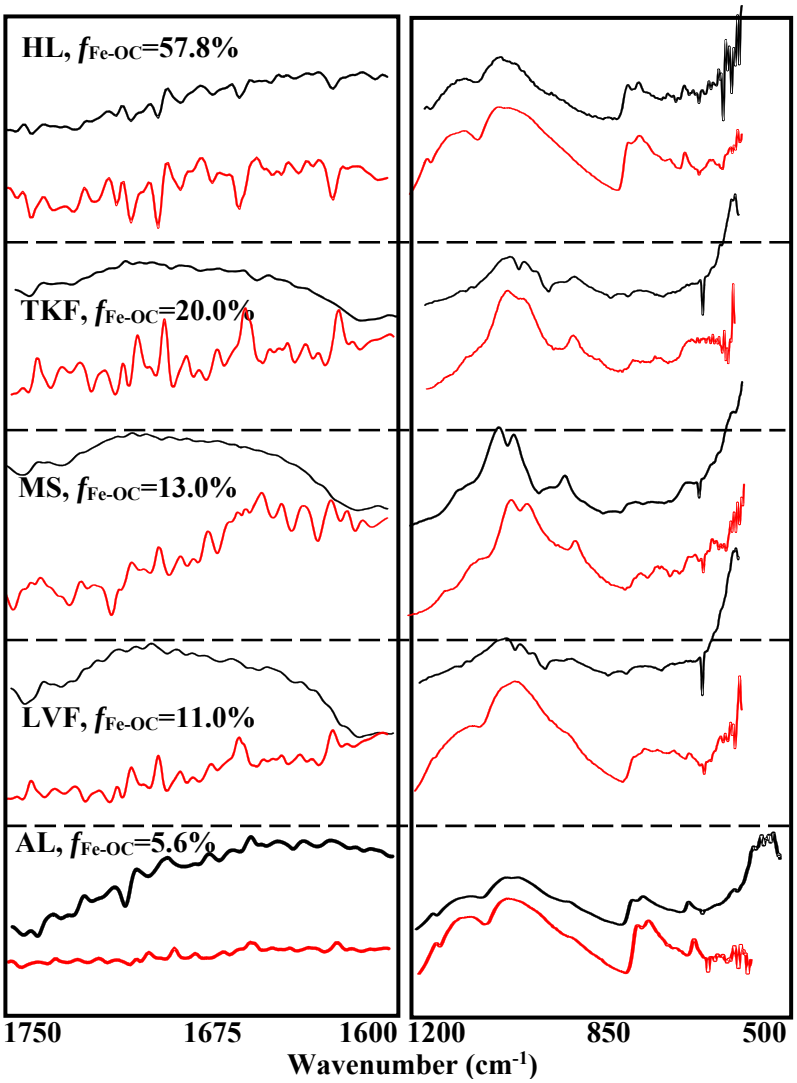

Figure S7. Attenuated total reflectance-Fourier transform infrared spectroscopy (ATR-FTIR) analysis for representative forest soils before (black line) and after Fe extraction (red line). All the spectra are background-calibrated. Among the 14 forest soils sampled in this study, we used five different forest soils, with $f_{Fe\text{-}OC}$ ranging 5.6-57.8%.

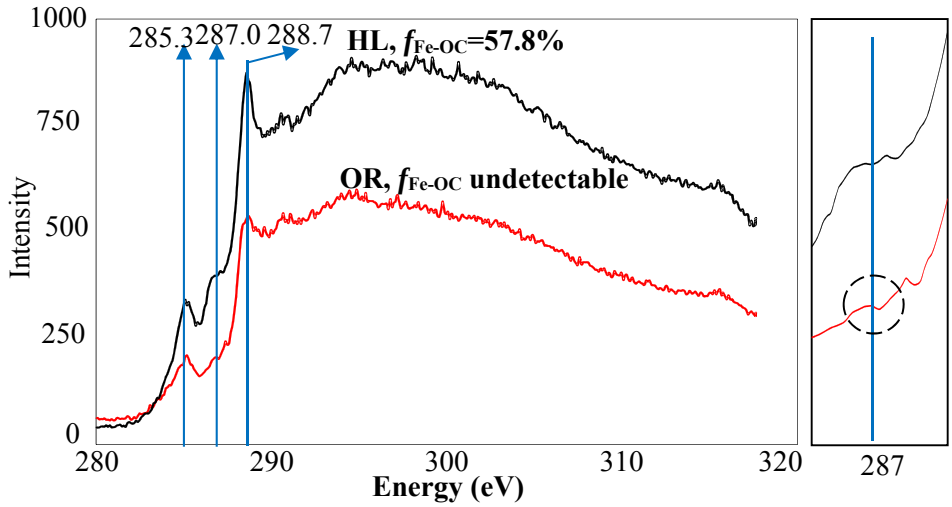

Figure S8. C 1s Near-edge X-ray absorption fine structure analysis (NEXAFS) for OR (Tennessee) soil (non-detectable $f_{Fe\text{-}OC}$) and HL (Maine) soil ($f_{Fe\text{-}OC}$ = 57.8%).

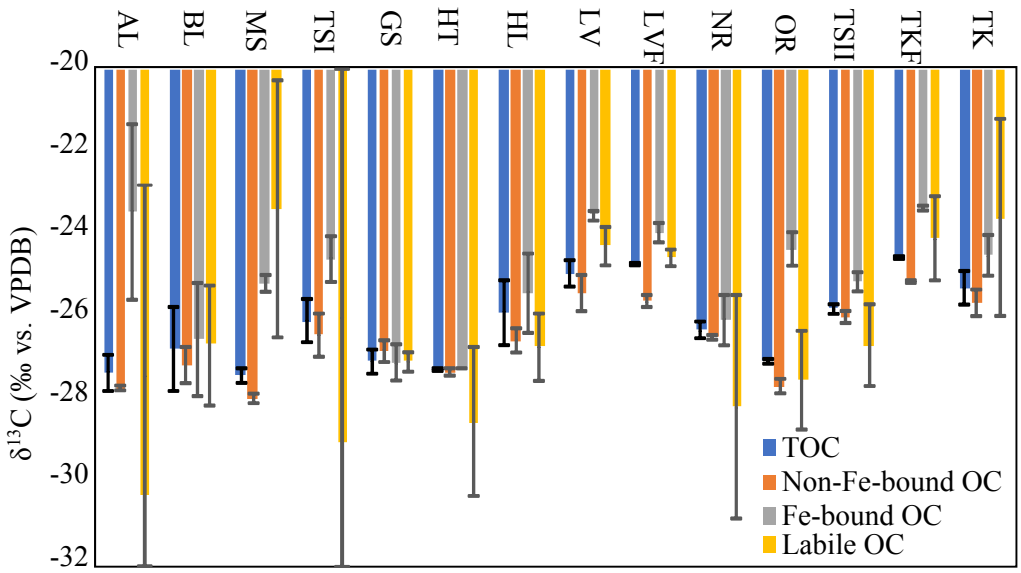

Figure S9. $\delta^{13}C$ of total organic carbon, non-iron bound organic carbon, iron-bound organic carbon, and labile organic carbon for 14 U.S. forest sites.

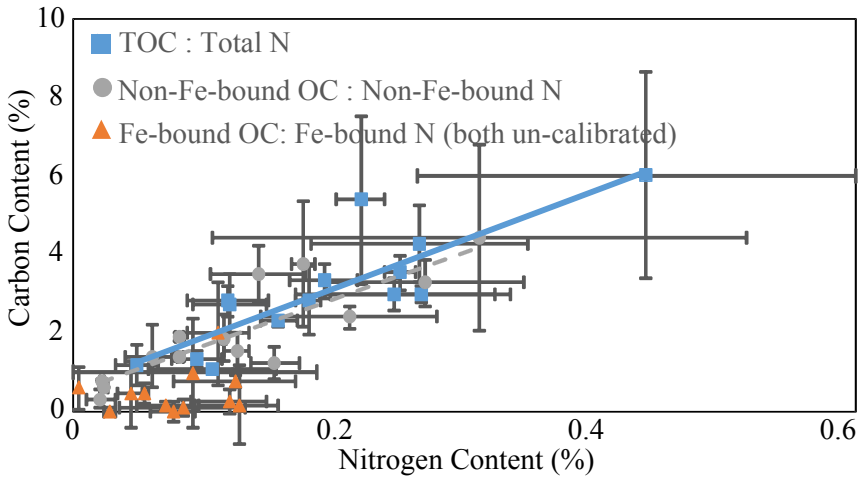

Figure S10. Variation of OC concentration vs. N concentration for bulk soils, Fe-bound OC, and non-Fe-bound OC.