Electronic Supplementary Material (ESI) for Environmental Science: Advances.

Supplementary material

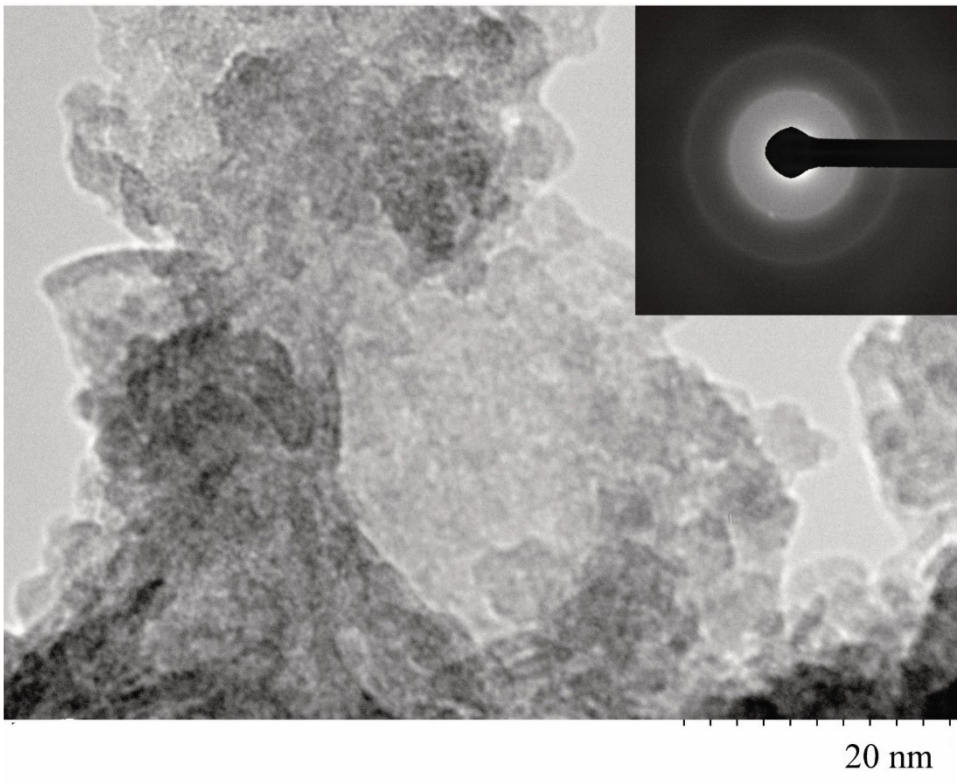

Fig. S1. TEM image and microdiffraction patterns of the reference sample.

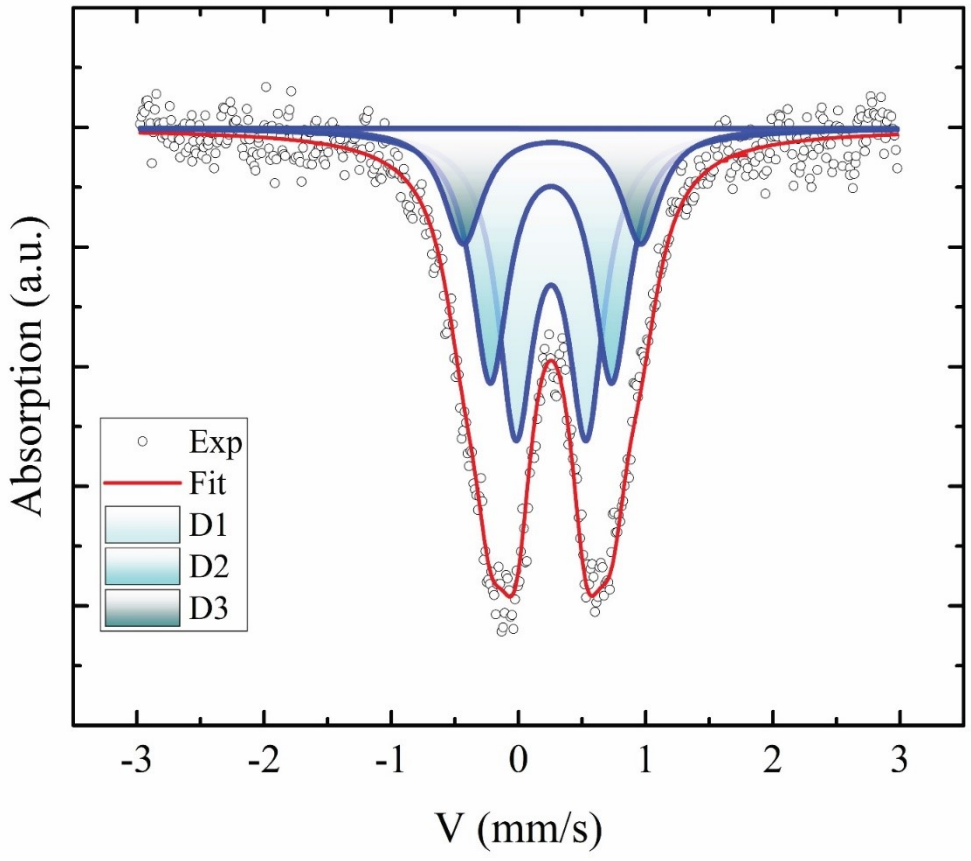

Fig. S2. Mössbauer spectrum of the reference sample at a temperature of 300 K. Shaded areas show the partial components obtained during processing.

Table S1. Mössbauer parameters of the sample in the temperature range of 4–300 K. IS is the chemical shift relative to α-Fe, H_{hf} is the hyperfine field on iron nuclei, QS is the quadrupole splitting, *W* is the Mössbauer line full width at half maximum, and *A* is the relative site occupancy.

	IS, mm/s ±0.005	*H*, kOe, ±3	QS, mm/s ±0.01	*W*, mm/s ±0.01	A, % ±0.03	Origin
300 K						
D1	0.363	--	0.56	0.34	0.45	$Fe_2O_3 \cdot nH_2O$
D2	0.365	--	0.97	0.35	0.36	
D3	0.371	--	1.37	0.37	0.19	

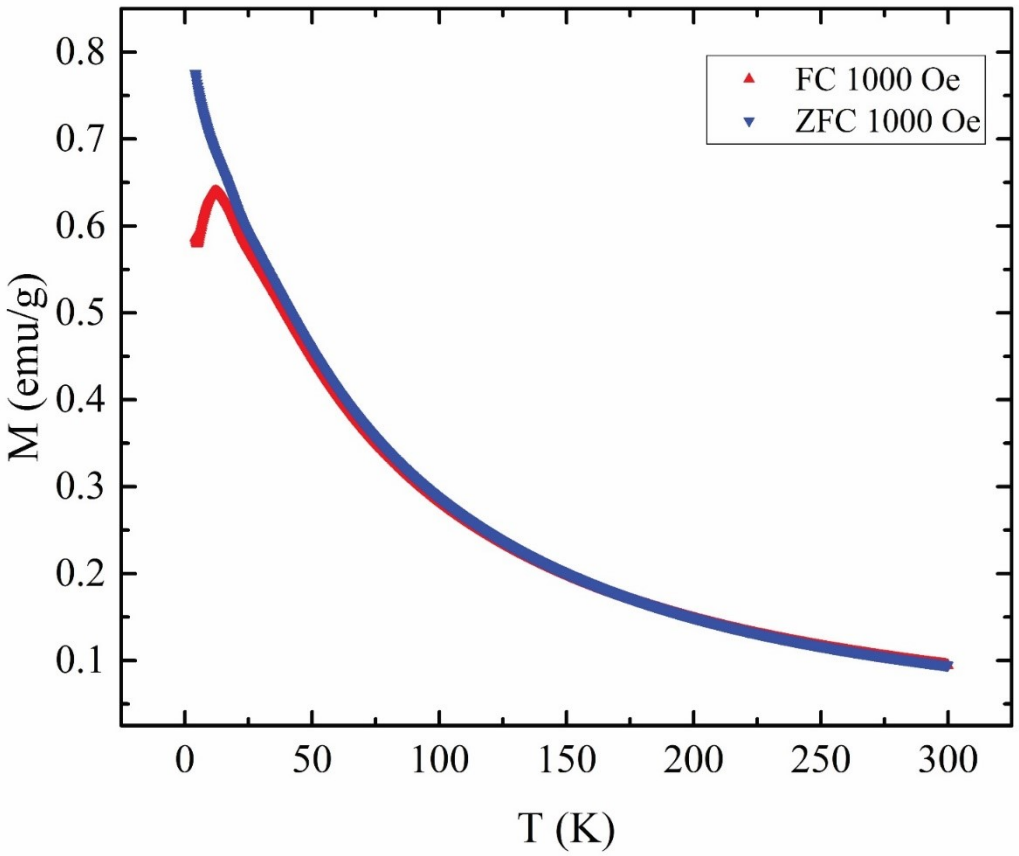

Fig. S3. FC and ZFC temperature dependences of the magnetization of the reference sample in a magnetic field of 1000 Oe.

Table S2. Averaging of the normalized atomic concentration in the sample according to the EDS data

Element	Series	Intensity [a.u.]	Concentration [wt %]	Concentration [at %]	(3 Sigma) [wt %]
Selected area (1)					
Iron	K-series	39898	42.78	20.86	3.99
Phosphorus	K-series	22919	18.7	16.44	1.8
Oxygen	K-series	22307	33.66	57.31	3.18
Sulfur	K-series	317	0.26	0.22	0.13
Magnesium	K-series	5955	4.6	5.15	0.53
Total:	--	--	100	100	
Selected area (2)					
Iron	K-series	30165	55.47	41.22	5.17
Phosphorus	K-series	261	0.39	0.52	0.16
Oxygen	K-series	334	0.86	2.24	0.24
Sulfur	K-series	32373	43.28	56.01	4.04
Total:	--	--	100	100	

Table S3. Mössbauer parameters of the sample from 4 to 300 K. δ is the chemical shift relative to α-Fe, H_{hf} is the hyperfine field on iron nuclei, Δ is the quadrupole splitting, *W* is the Mössbauer line FWHM, *dW* is the line broadening, and *A* is the relative site occupancy.

	δ, mm/s ±0.005	H_{hf}, kOe, ±3	Δ/2, mm/s ±0.01	*W*, mm/s ±0.01	*dW*, mm/s ±0.01	*A*, a.u ±0.03	Origin
300 K							
S1	0.437	304	-0.15	0.74	0.47	0.05	Fe_3S_4
D1	1.214	--	2.51	0.39	--	0.10	$Fe_3(PO_4)_2{\cdot}8H_2O$
D2	1.266	--	2.92	0.22	--	0.05	
D3	1.242	--	1.84	0.29	--	0.13	$FeCO_3$
D4	0.365	--	0.54	0.42	--	0.29	
D5	0.372	--	0.67	0.44	--	0.14	$Fe_2O_3{\cdot}nH_2O$
D6	0.34	--	1.03	0.47	--	0.24	
250 K							
S1	0.447	306	-0.15	0.74	0.47	0.05	Fe_3S_4
S2	0.388	311	-0.15	0.10	2.85	0.25	$Fe_2O_3{\cdot}nH_2O$
D1	1.351	--	2.47	0.40	--	0.09	$Fe_3(PO_4)_2{\cdot}8H_2O$
D2	1.353	--	2.96	0.22	--	0.04	
D3	1.284	--	1.94	0.34	--	0.11	$FeCO_3$
D4	0.378	--	0.50	0.40	--	0.16	
D5	0.377	--	0.82	0.46	--	0.18	$Fe_2O_3{\cdot}nH_2O$ (SPM)
D6	0.336	--	1.15	0.40	--	0.12	
200 K							
S1	0.459	314	-0.12	0.30	0.00	0.05	Fe_3S_4
S2	0.449	410	-0.27	1.07	0.00	0.11	$Fe_2O_3{\cdot}nH_2O$
S3	0.567	333	0.00	0.10	3.64	0.27	
D1	1.364	--	2.38	0.42	--	0.10	$Fe_3(PO_4)_2{\cdot}8H_2O$
D2	1.441	--	2.86	0.20	--	0.03	
D3	1.317	--	1.91	0.31	--	0.09	$FeCO_3$
D4	0.414	--	0.51	0.43	--	0.15	$Fe_2O_3{\cdot}nH_2O$ (SPM)
D5	0.342	--	0.98	0.47	--	0.08	
D6	0.379	--	1.16	0.39	--	0.12	
140 K							
S1	0.527	322	0.03	0.52	0.0	0.04	Fe_3S_4
S2	0.407	434	-0.02	0.65	0.50	0.16	$Fe_2O_3{\cdot}nH_2O$
S3	0.348	367	-0.38	0.19	2.79	0.29	
D1	1.417	--	2.60	0.41	--	0.08	$Fe_3(PO_4)_2{\cdot}8H_2O$
D2	1.306	--	3.28	0.18	--	0.04	
D3	1.348	--	2.07	0.33	--	0.10	$FeCO_3$
D4	0.396	--	0.64	0.59	--	0.18	$Fe_2O_3{\cdot}nH_2O$ (SPM)
D5	0.418	--	0.91	0.37	--	0.10	

	δ, mm/s ±0.005	H_{hf}, kOe, ±3	Δ/2, mm/s ±0.01	*W*, mm/s ±0.01	*dW*, mm/s ±0.01	*A*, a.u ±0.03	Origin
				110 K			
S1	0.567	321	0.01	0.37	0.0	0.04	Fe_3S_4
S2	0.525	445	-0.14	0.67	0.56	0.27	$Fe_2O_3 \cdot nH_2O$
S3	0.518	325	-0.13	0.10	3.74	0.22	
D1	1.422	--	2.35	0.31	--	0.07	$Fe_3(PO_4)_2 \cdot 8H_2O$
D2	1.357	--	3.10	0.35	--	0.05	
D3	1.370	--	2.04	0.30	--	0.09	$FeCO_3$
D4	0.411	--	0.72	0.44	--	0.11	$Fe_2O_3 \cdot nH_2O$
D5	0.466	--	0.88	0.61	--	0.15	(SPM)
				80 K			
S1	0.562	323	0.11	0.43	0.07	0.05	Fe_3S_4
S2	0.503	465	-0.08	0.53	0.43	0.22	$Fe_2O_3 \cdot nH_2O$
S3	0.474	392	-0.13	0.48	1.97	0.30	
D1	1.472	--	2.55	0.40	--	0.08	$Fe_3(PO_4)_2 \cdot 8H_2O$
D2	1.372	--	3.24	0.24	--	0.04	
D3	1.399	--	2.10	0.37	--	0.09	$FeCO_3$
D4	0.412	--	0.64	0.46	--	0.11	$Fe_2O_3 \cdot nH_2O$
D5	0.459	--	1.06	0.50	--	0.12	(SPM)
				50 K			
S1	0.612	326	0.05	0.44	0.10	0.04	Fe_3S_4
S2	0.519	483	-0.10	0.49	0.24	0.19	
S3	0.481	347	-0.34	0.10	3.89	0.21	$Fe_2O_3 \cdot nH_2O$
S4	0.490	443	0.00	0.45	0.74	0.18	
D1	1.511	--	2.64	0.69	--	0.09	$Fe_3(PO_4)_2 \cdot 8H_2O$
D2	1.371	--	3.27	0.17	--	0.04	
D3	1.429	--	2.21	0.52	--	0.08	$FeCO_3$
D4	0.393	--	0.66	0.58	--	0.09	$Fe_2O_3 \cdot nH_2O$
D5	0.449	--	0.99	0.55	--	0.10	(SPM)
				4.2 K			
S1	0.624	327	0.00	0.42	0.16	0.05	Fe_3S_4
S2	0.510	490	-0.17	0.38	0.39	0.28	
S3	0.512	512	-0.08	0.42	0.11	0.18	$Fe_2O_3 \cdot nH_2O$
S4	0.501	461	0.03	0.51	0.96	0.24	
S5	1.231	223	-2.44	1.33	0.40	0.08	$Fe_3(PO_4)_2 \cdot 8H_2O$
S6	1.423	136	2.58	0.26	0.46	0.07	
S7	1.359	169	2.05	0.20	1.00	0.12	$FeCO_3$