

**Title: Iron and iron-bound phosphate accumulate in surface soils of arctic polygonal tundra**

Authors: Elizabeth Herndon<sup>1,2\*</sup>, Lauren Kinsman-Costello<sup>3</sup>, Nicolle Di Domenico<sup>2</sup>, Kiersten Duroe<sup>2</sup>, Maximilian Barczok<sup>2</sup>, Chelsea Smith<sup>3</sup>, Stan Wulfschleger<sup>1</sup>

<sup>1</sup>Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN

<sup>2</sup>Department of Geology, Kent State University, Kent, OH

<sup>3</sup>Department of Biological Sciences, Kent State University, Kent, OH

\*corresponding author: herndonem@ornl.gov

Submitted to Environmental Science: Processes and Impacts

Special Issue: Cryosphere Chemistry

Table S1. Spreadsheet (.csv) of chemical info and Fe and P extraction results for each soil horizon

Table S2. Spreadsheet (.csv) of Fe extraction results for soil cores

Table S3. Fe K-edge XANES spectra (.csv)

Table S4. Fe K-edge EXAFS spectra + fits (.csv.)

Table S5. Iron oxidation state and proportions of major Fe-bearing components in depth increments from soil cores

Site	Depth cm	Ave. Fe Valence	XANES Red. $\chi^2$	Fe <sup>II</sup> -oxalate %	Fe <sup>III</sup> -oxalate %	Fe <sup>III</sup> -citrate %	Ferrihydrite %	Chlorite %	k <sup>2</sup> Red. $\chi^2$
HC-Center	0 – 4	n.a.	n.a.	14	14	0	50	22	0.034
HC-Center	4 – 8	n.a.	n.a.	27	0	0	56	17	0.045
HC-Center	8 – 12	n.a.	n.a.	14	11	0	46	29	0.035
HC-Center	12 – 16	2.77	0.153	11	9	8	47	25	0.008
HC-Center	16 – 20	2.77	0.030	0	14	16	42	27	0.004
HC-Center	20 – 24	2.77	0.035	0	7	24	45	24	0.007
HC-Center	24 – 29	2.77	0.070	0	4	23	39	34	0.005
HC-Trough	0 – 4	2.87	0.186	1	10	21	50	18	0.017
HC-Trough	4 – 8	2.87	0.207	15	10	11	53	11	0.018
HC-Trough	8 – 12	2.87	0.019	0	19	13	59	9	0.016
HC-Trough	12 – 16	2.87	0.017	0	19	23	48	10	0.005
HC-Trough	16 – 20	2.93	0.024	0	16	48	30	6	0.004
HC-Trough	20 – 26	2.93	0.067	1	19	27	41	12	0.007
LC-Center	0 – 4	2.93	0.040	0	0	49	39	11	0.008
LC-Center	4 – 8	2.93	0.047	0	0	44	46	11	0.009
LC-Center	8 – 13	2.94	0.023	0	0	57	31	12	0.006
LC-Ridge	0 – 4	2.90	0.146	0	0	13	76	11	0.030
LC-Ridge	4 – 8	2.92	0.052	0	0	44	42	14	0.011
LC-Ridge	8 – 12	2.77	0.029	0	15	23	36	26	0.004
LC-Ridge	12 – 16	2.78	0.022	0	14	25	36	24	0.004
LC-Ridge	16 – 19	2.81	0.045	0	5	36	38	21	0.010
LC-Trough	0 – 4	2.92	0.060	0	0	36	51	13	0.011
LC-Trough	4 – 8	2.90	0.047	0	0	46	41	15	0.008
LC-Trough	8 – 12	2.92	0.050	0	0	42	43	15	0.010
LC-Trough	12 – 16	2.72	0.050	0	4	22	40	33	0.009
LC-Trough	16 – 20	2.88	0.051	0	3	43	40	14	0.013

Figure S1. Depth profiles for five individual soil cores taken from each landscape feature. Error bars representing analytical error for dithionite-soluble Fe ( $= 0.9 \mu\text{mol g}^{-1}$ ), dithionite-soluble P ( $= 1.1 \mu\text{mol g}^{-1}$ ), and water-soluble P ( $= 0.06 \mu\text{mol g}^{-1}$ ) are smaller than the symbol.



