

# The Composition and Stability of Clay-Associated Organic Matter along a Soil Profile

Chunmei Chen<sup>1\*</sup>, Peter Leinweber<sup>2</sup>, Kai-Uwe Eckhardt<sup>2</sup>, Donald L. Sparks<sup>1</sup>

1. Department of Plant and Soil Sciences

Delaware Environmental Institute

University of Delaware, Newark, DE, USA 19711

2. Soil Science,

University of Rostock, Justus-von-Liebig-Weg 6, Rostock, Germany

Corresponding Author

\*Phone: (302)9833299. E-mail: [cmchen@udel.edu](mailto:cmchen@udel.edu)

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Table S1: General Soil Description.

Horizon	Depth	Summit	Footslope
A	0-15	Dark grayish brown (10YR 4/2) loam; weak fine granular structure; many fine roots	Dark grayish brown (10YR 4/2) loam; weak medium subangular blocky structure; many fine roots
B	15-25	Yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; few fine roots	Grayish brown (10YR 5/2) loam; moderate medium subangular blocky structure; few fine roots
B	25-35	Yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure	Grayish brown (10YR 5/2) loam; moderate medium subangular blocky structure

Table S2: Bulk Soil Properties.

Landscape location	Soil depth (cm)	Sand (%)	Silt (%)	Clay (%)	Exch. Cations (meq/100g)				CEC @ pH7 (meq/100g)
					Ca	K	Mg	Na	
Summit	0-15	41	39	20	6.53	0.35	1.66	0.06	17.40
	15-25	41	39	20	4.68	0.11	1.19	0.04	15.75
	25-35	39	41	20	1.25	0.10	0.72	0.05	9.86
Footslope	0-15	37	41	22	5.51	0.21	1.72	0.02	15.89
	15-25	35	41	24	3.94	0.06	1.27	0.05	14.19
	25-35	36	40	24	0.75	0.07	0.48	0.02	8.39

Table S3. Total Fe, dithionite-extractable Fe, and oxalate-extractable Fe in bulk soils.

Landscape location	Soil depth (cm)	Total Fe (Fe <sub>t</sub> ) (%)	Dithionite-extractable Fe (Fe <sub>d</sub> ) (%)	Oxalate-extractable Fe (Fe <sub>o</sub> ) (%)
	0-15	2.75	1.62	0.50
Summit	15-25	2.83	1.61	0.54
	25-35	2.79	1.62	0.52
	0-15	2.35	1.26	0.66
Footslope	15-25	2.22	1.19	0.70
	25-35	2.16	1.09	0.70

Table S4: Marker signals in Py-FIMS of soil samples.

**Carbohydrates**

60,61,72,82,84,96,98,110,112, 114,126,132,144,162,163

**Phenols+lignin monomers**

94,108,110,122,124,138,140, 150,152,154,164,166,168,178, 180,182,194,196,208,210,212

**Lignin dimers**

246,260,270,272,274,284,286,296, 298,300,310,312,314,316,326, 328,330,340,342,356

**Lipids, alkanes, alkenes, fatty acids, n-alkyl esters**

202,216,230,244,256,258,270,272,284,286,298,300,312,314,326,328,340,342,354,368,380,382,  
394,396,408,410,422,424,438,452,466,480,494,508,522,536,550,564,578,592,606,620,634,648,  
662,676,704,718,732,746

**Alkylaromatics**

92,106,120,134,142,148,156,162,170,176,184,190,192,198,204,206,218,220,232,234,246,260  
274,288,302,316,330,344,358,372,386

**Heterocyclic nitrogen and nitriles**

67,79,81,93,95,103,109,111,117,123,137,139,153,161

**Sterols**

372,386,388,390,392,394,396,398,400,402,408,410,412,414,416,426,430

**Amides (amino acids, peptides and aminosugars)**

58, 59, 70,73,74,75,84,87,91,97,115,120,129,135,167,185,203,243,276

**Suberin**

432,446,460,474,488,502,516,530

**Fatty acids n-C16 to n-C34**

256,270,278,280,282,284,298,312,326,340,354,368,382,396,410,424,438,452,466, 480,494,508

Table S5: Compound class groups of marker signals from pyrolysis-field ionization mass spectrometry of whole soils and their clay fractions from summit at soil depth 0-15 and 15-25 cm, and footslope at soil depth of 0-15 and 25-35 cm.

Landscape location	Soil depth (cm)	Soil fractions	CHYDR	PHLM	LDIM	LIPID	ALKYL	NCOMP	STEROL	PEPTI	FATTY
			% TII								
Summit	0-15	Whole soil	7.1	9.4	2.7	4.5	9.5	3.9	1.6	6.8	0.5
		Clay fraction	7.9	8.9	2.4	4.3	9.1	4.3	1.7	7.5	0.9
	15-25	Whole soil	8.8	14.2	1.4	4.9	12.9	6.1	0.8	7.9	0.0
		Clay fraction	8.6	11.0	1.7	5.5	12.1	5.2	1.0	7.1	0.7
Footslope	0-15	Whole soil	7.0	8.8	2.8	5.0	9.5	3.5	2.0	6.2	0.9
		Clay fraction	7.1	8.7	2.6	5.2	9.9	3.7	2.2	6.3	1.2
	15-25	Whole soil	8.4	22.1	0.3	3.9	21.3	9.1	0.0	10.1	0.0
		Clay fraction	7.8	21.0	0.3 c	3.9	22.9	8.6	0.0 d	9.5	0.1

Statistics of each compound class between whole soil samples and soil clay fractions

*NS*     *p* < 0.05     *NS*     *NS*     *NS*     *NS*     *NS*     *NS*     *NS*     *p* < 0.01

CHYDR = carbohydrates; PHLM = phenols + lignin monomers; LDIM = lignin dimers; LIPID = lipids, alkanes, alkenes, and n-alkyl esters; ALKYL = alkylaromatics; NCOMP = heterocyclic nitrogen and nitriles; STEROL = sterols; PEPTI = amides (amino acids, peptides and amino sugars); FATTY = fatty acids.

*NS*: non-significant.

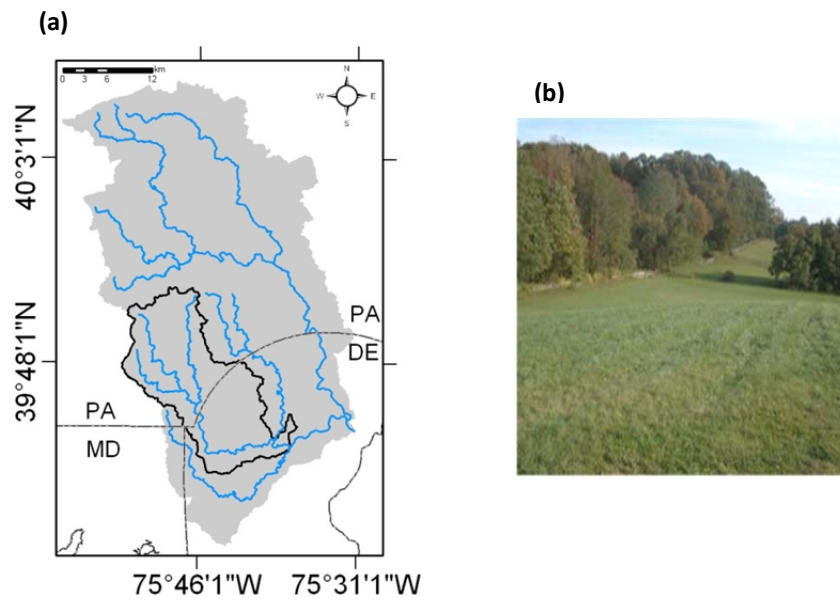


Figure S1: (a) Map of Christina River Basin ( $\sim 1440 \text{ km}^2$ ) (marked with black color). (b) Picture of the sampled pasture hillslope.

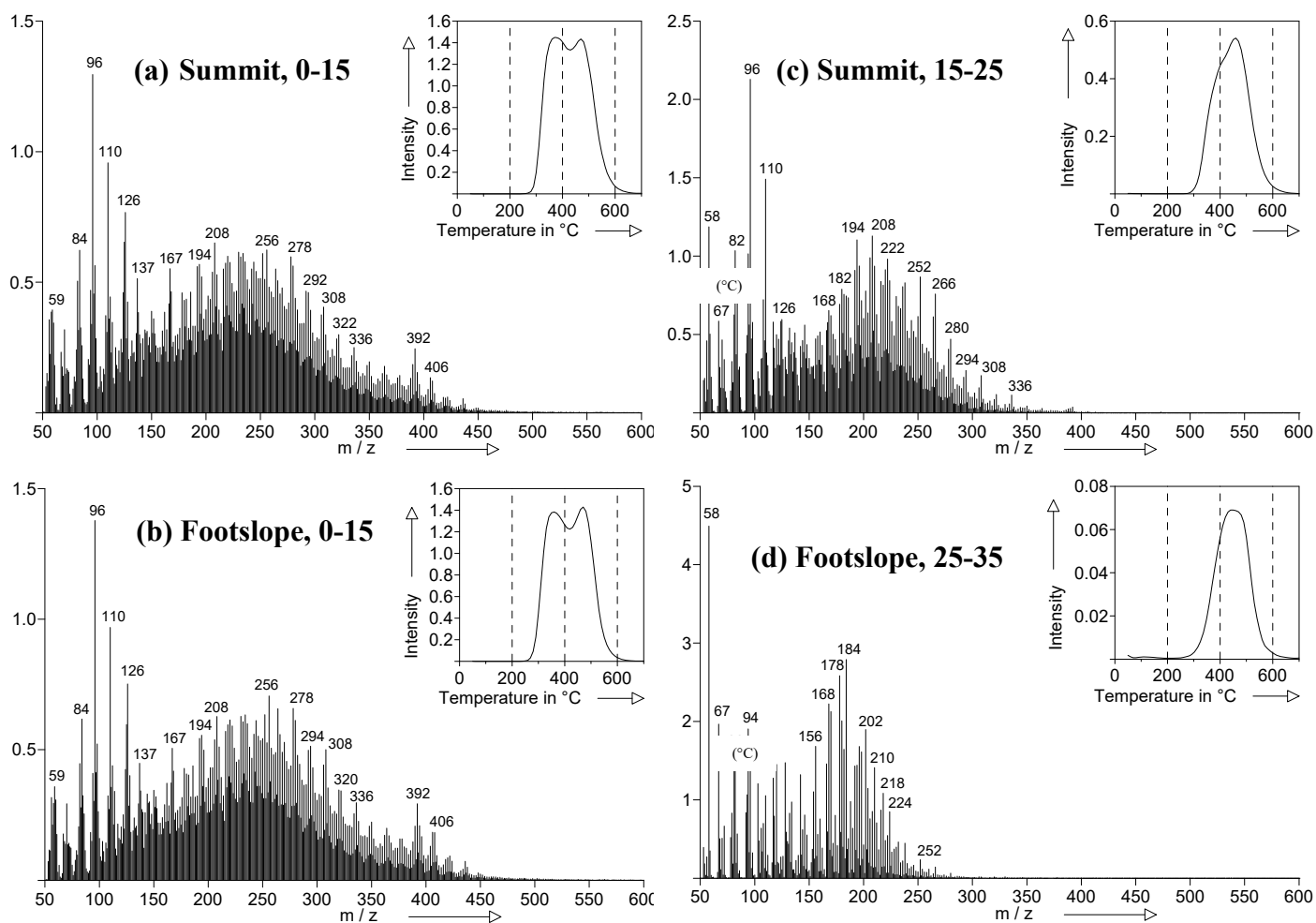


Figure S2: Summed and averaged pyrolysis-field ionization mass spectra and thermograms of total ion intensity (TII, inset) of whole soils from summit at soil depth 0-15 and 15-25 cm, and footslope at soil depth of 0-15 and 25-35 cm.



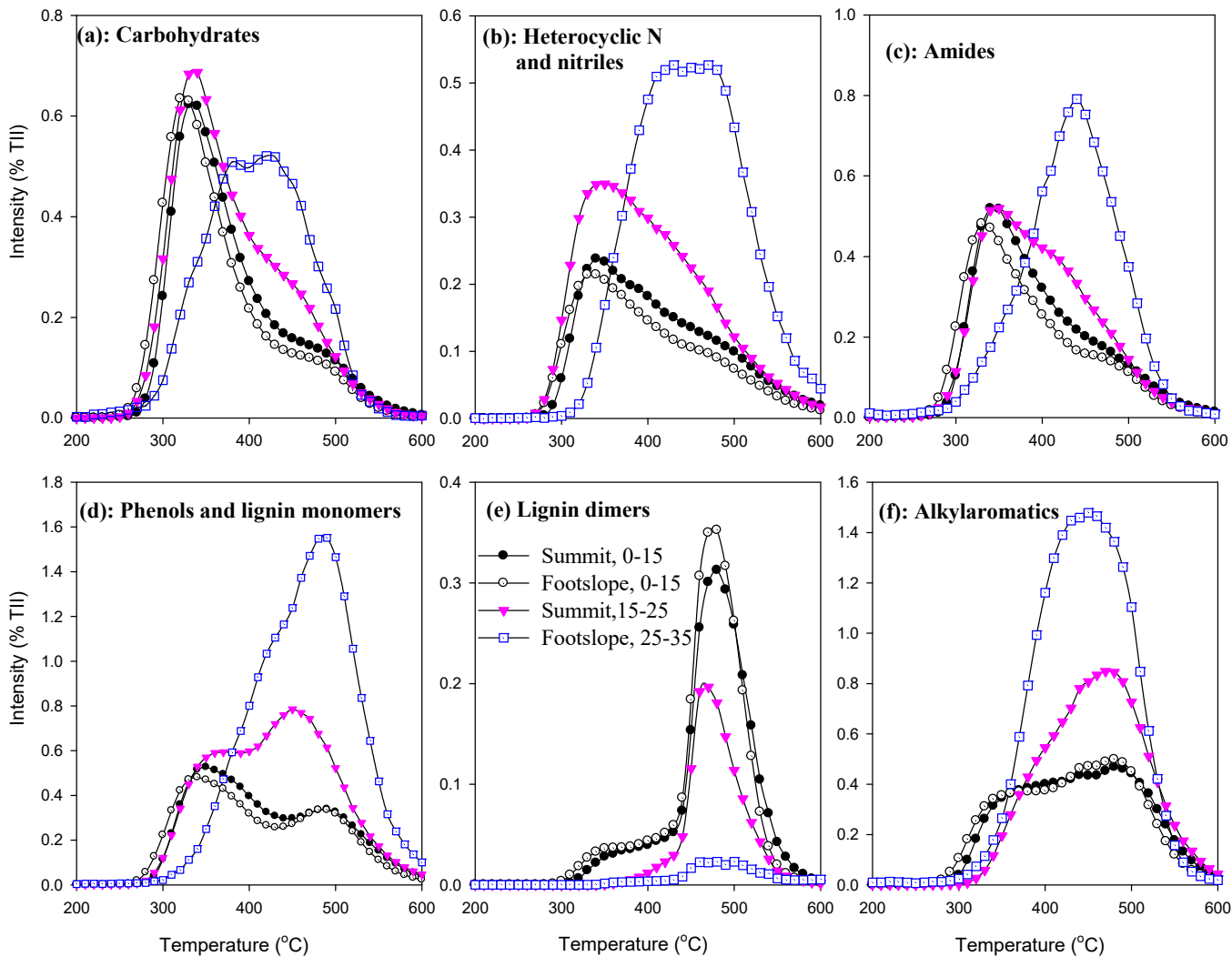


Figure S3: Pyrolysis thermograms of (a) carbohydrates, (b) heterocyclic nitrogen and nitriles, (c) amides, (d) phenols and lignin monomers, (e) lignin dimers, and (f) alkylaromatics for whole soils from summit at soil depth 0-15 and 15-25 cm, and footslope at soil depth of 0-15 and 25-35 cm.