Lability classification of soil organic matter in the northern permafrost region

Kuhry et al., Supplement

Captions for Tables and Figures in Supplemental Materials

Table S1. Overview of field study areas and incubated samples

Figure S1. Cross correlations between geochemical parameters for all samples in the four incubation experiments: a-c, PAGE21; d-f, CryoCarb 1-Kolyma; g-i, CryoCarb 2-Taymyr; j-l, CryoCarb 3-Seida. All regressions significant (p<0.05).

Figure S2. Correlations between geochemical parameters and µgC-CO₂ production per gram dry weight (gdw) for all samples in the four incubation experiments: a-c, PAGE21; d-f, CryoCarb 1-Kolyma; g-i, CryoCarb 2-Taymyr; j-l, CryoCarb 3-Seida. All regressions significant (p<0.05).

Figure S3. µgC-CO₂ production per gram dry weight as a function of %C of the sample for the different landscape unit classes in the CryoCarb 2-Taymyr (a, top panel) and CryoCarb 3-Seida (b, lower panel) incubation experiments: Alluvial class (red line and diamonds, CryoCarb 2-Taymyr experiment only); Mineral class (brown line and squares); Peaty wetland class (light green line and circles); Peatland class (dark green line and circles). All regressions significant, p<0.05, except for peat deposits in the CryoCarb 2-Taymyr dataset (n.s.).

Figure S4. µgC-CO₂ production per gram dry weight as a function of C/N of the sample for the different landscape unit classes in the PAGE21 (a, top panel left), CryoCarb 1-Kolyma (b, lower panel left), CryoCarb 2-Taymyr (c, top panel right) and CryoCarb 3-Seida (d, lower panel right) incubation experiments: Alluvial class (red line and diamonds); Eolian class (blue line and triangles); Mineral class (brown line and squares); Peaty wetland class (dark green line and circles); Peatland class (light green line and circles). All regressions significant, p<0.05, except for peaty wetland and peat deposits in the PAGE21 dataset and peat deposits in the CryoCarb 1-Kolyma and CryoCarb 3-Seida datasets (n.s.). Note that not all landscape unit classes are represented in all four incubation experiments.

Figure S5. a) µgC-CO₂ production per gram carbon as a function of %C of the sample and b) µgC-CO₂ production per cm³ as a function of %C of the sample, for the different landscape classes in the PAGE21 dataset: Alluvial class (red line and diamonds); Eolian class (blue line and triangles); Mineral class (brown line and squares); Peaty wetland class (dark green line and circles); Peatland class (light green line and circles). Non-significant regressions, p>0.05, are marked n.s.

Figure S6. C content (as %C of dry weight) in samples of (a) the PAGE21 and (b) the CryoCarb 1-Kolyma incubation experiments, grouped according to soil horizon criteria. Abbreviations: AL-OL = Active layer topsoil organics; AL-Min = Active layer mineral; AL-Ce = Active layer C-enriched; P-Min = Permafrost layer mineral; P-Ce = Permafrost layer C-enriched; AL-Pty =
Active layer thin peat (CryoCarb 1-Kolyma experiment only); AL-Pt = Active layer peat; P-Pt = Permafrost layer peat (CryoCarb 1-Kolyma experiment only); AL-Lss OL = Active layer topsoil organics in Late Holocene loess deposits (PAGE21 experiment only); AL-Lss Min = Active layer mineral in Late Holocene loess deposits (PAGE21 experiment only); P-Lss Min = Permafrost layer mineral in Late Holocene loess deposits (PAGE21 experiment only); P-Yed = Permafrost Pleistocene Yedoma deposits (CryoCarb 1-Kolyma experiment only); Th-Yed = Thawed out Pleistocene Yedoma deposits (CryoCarb 1-Kolyma experiment only). Box-whisker plots show mean and standard deviation (in red) and median, first and third quartiles and min/max values (in black), for the different soil horizon groups.
<table>
<thead>
<tr>
<th>Study area</th>
<th>Geographic location</th>
<th>Approximate coordinates</th>
<th>Permafrost zone</th>
<th>Vegetation zone</th>
<th>Mean Annual/July Temperatures</th>
<th>Nr profiles / incubated soil samples</th>
<th>Partner and incubation experiment</th>
<th>Time of soil sampling</th>
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<tbody>
<tr>
<td>Ny Ålesund</td>
<td>Svalbard</td>
<td>78.9 N, 11.7 E</td>
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<td>Tundra</td>
<td>-5.8/+5.2</td>
<td>16 / 24</td>
<td>UCOP_PAGE21</td>
<td>Summer 2013</td>
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<td>Svalbard</td>
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<td>Tundra</td>
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<td>-12.5/+10.1</td>
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<td>Chersky</td>
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<td>Forest (-Tundra), Lowland, Alpine</td>
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<td>NW Russia</td>
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<td>Discontinuous</td>
<td>Tundra, Forest Islands</td>
<td>-6.1/+13.0</td>
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<td>Alpine treeline ecotone</td>
<td>-0.2/+11.6</td>
<td>5 / 13</td>
<td>UCOP_PAGE21</td>
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Figure S2.

(a) Graph showing the relationship between dry bulk density (g cm\(^{-3}\)) and \(\mu g\)C\(_{CO_2}\) gdw\(^{-1}\) d\(^{-1}\), with an R\(^2\) value of 0.52.

(b) Graph showing the relationship between %C of dry weight and \(\mu g\)C\(_{CO_2}\) gdw\(^{-1}\) d\(^{-1}\), with an R\(^2\) value of 0.45.

(c) Graph showing the relationship between C/N weight ratio and \(\mu g\)C\(_{CO_2}\) gdw\(^{-1}\) d\(^{-1}\), with an R\(^2\) value of 0.34.

(d) Graph showing the relationship between dry bulk density (g cm\(^{-3}\)) and \(\mu g\)C\(_{CO_2}\) gdw\(^{-1}\) d\(^{-1}\), with an R\(^2\) value of 0.52.

(e) Graph showing the relationship between %C of dry weight and \(\mu g\)C\(_{CO_2}\) gdw\(^{-1}\) d\(^{-1}\), with an R\(^2\) value of 0.47.

(f) Graph showing the relationship between C/N weight ratio and \(\mu g\)C\(_{CO_2}\) gdw\(^{-1}\) d\(^{-1}\), with an R\(^2\) value of 0.54.
Figure S3

a

**TAYMYR**

- Alluvial, $R^2 = 0.84$
- Alluvial, slope = 26.2
- Other mineral, $R^2 = 0.63$
- Other mineral, slope = 24.7
- Peaty wetland, $R^2 = 0.74$
- Peaty wetland, slope = 29.3
- Peatland, $R^2 = -0.15$ (n.s.)
- Peatland, slope = 6.24
- All samples, $R^2 = 0.33$
- All samples, slope = 14.6

b

**SEIDA**

- Other mineral, $R^2 = 0.96$
- Other mineral, slope = 7.92
- Peaty wetland, $R^2 = 0.76$
- Peaty wetland, slope = 5.76
- Peatland, $R^2 = 0.26$
- Peatland, slope = 2.40
- All samples, $R^2 = 0.43$
- All samples, slope = 3.60
Figure S4.

a. PAGE21

b. CryoCarb 1-Kolyma

c. CryoCarb 2-Taymyr

d. CryoCarb 3-Seida
Figure S5.

a

b