



Structure regeneration in 2-mm sieved soils of varying clay mineralogy



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Introduction

- Soil structure is essential to all soil ecosystem functions and services.
- Activities that physically disrupt soil structure significantly affects most soil functions

Objectives

- Quantify newly-formed structure of physically disturbed samples of varying clay mineralogy
- Assess the effect of organic amendment on structure development

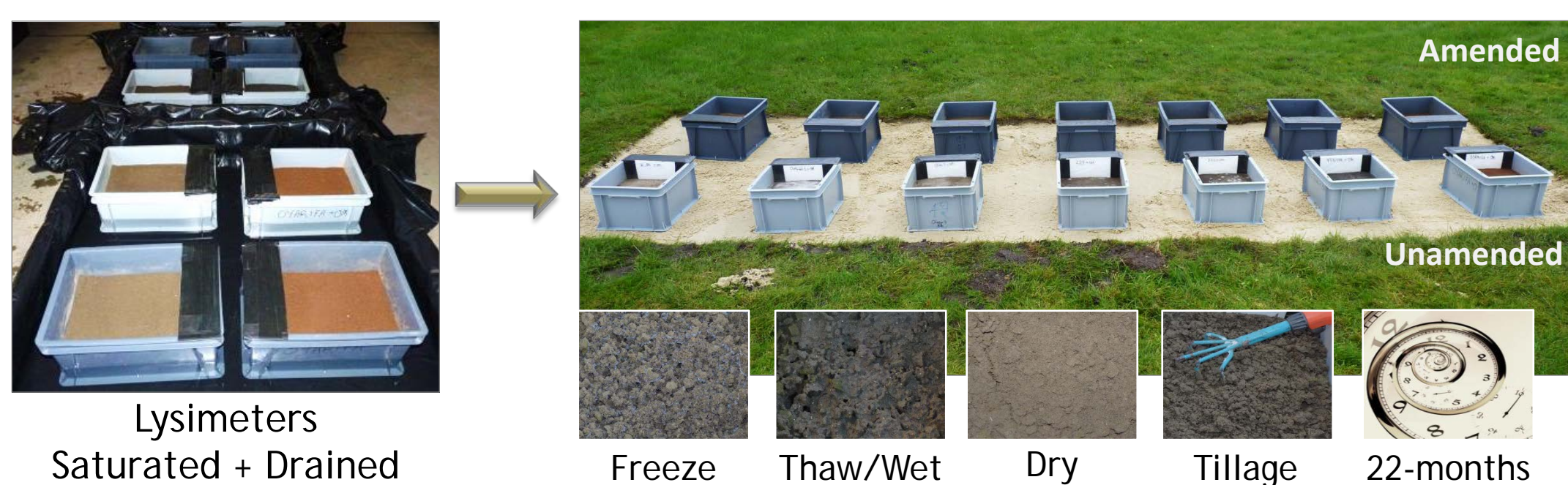
Methods - Soils

Soil	Mineralogy	Clay	Silt	Sand	OC
g 100 g ⁻¹					
KA	Kaolinite	16	16	66	0.88
MO	Smectite	42	15	42	1.29
IL1	Illite	17	27	52	1.92
IL2	Illite	19	25	53	1.35
IL3	Illite	16	28	52	2.02
IL4	Illite	17	25	55	1.42
IL5	Illite	18	24	50	1.00

Sample preparation



Field Incubation



Sampling (22 months later)



Methods - Measurements

Intact soil cores

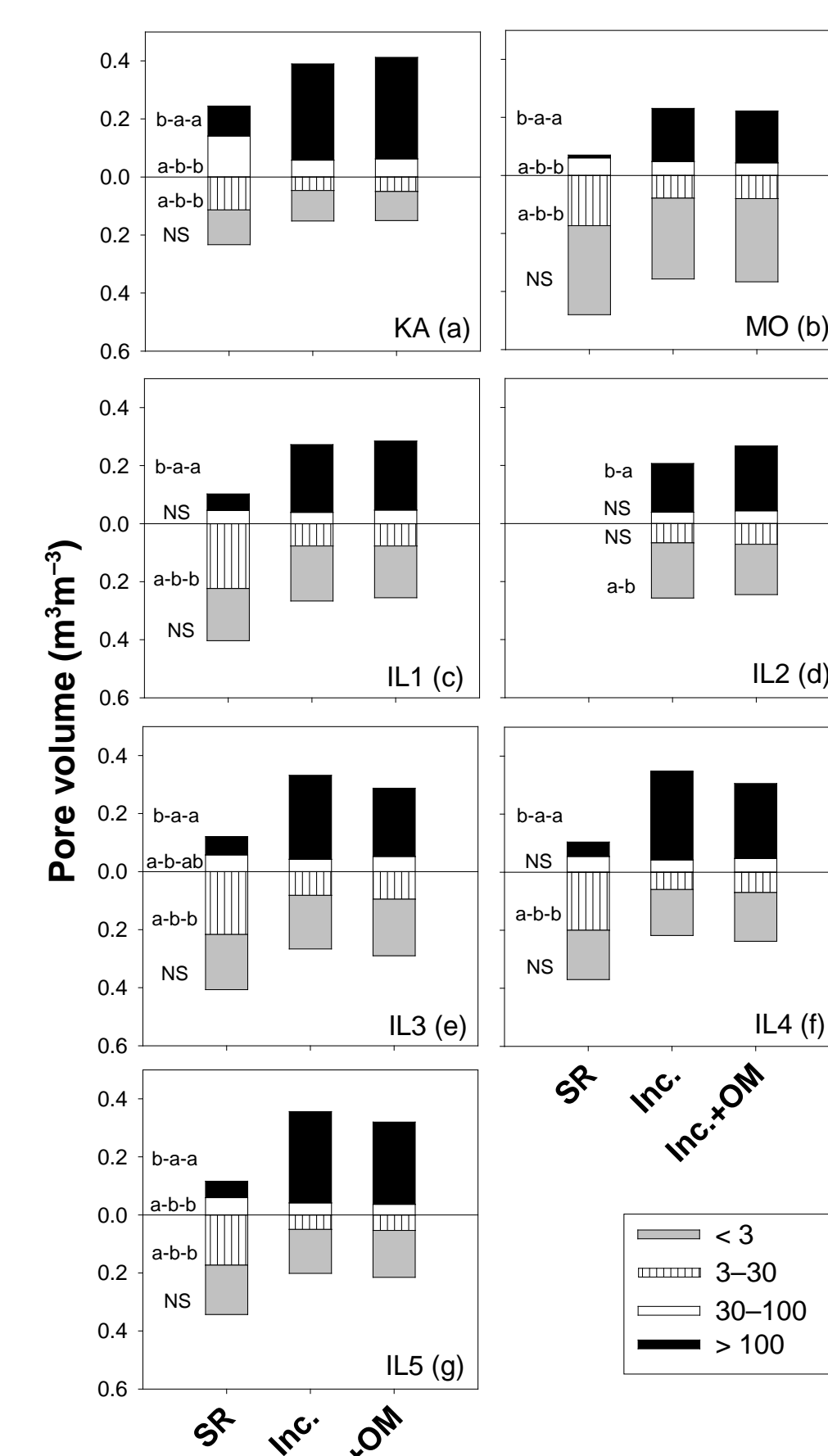
- Water retention, bulk density, relative gas diffusivity (D_p/D_0), air permeability (k_a),
- Structure complexity, $P = k_a / (D_p/D_0)$
Compared with sieved-repacked (SR) cores

Aggregates

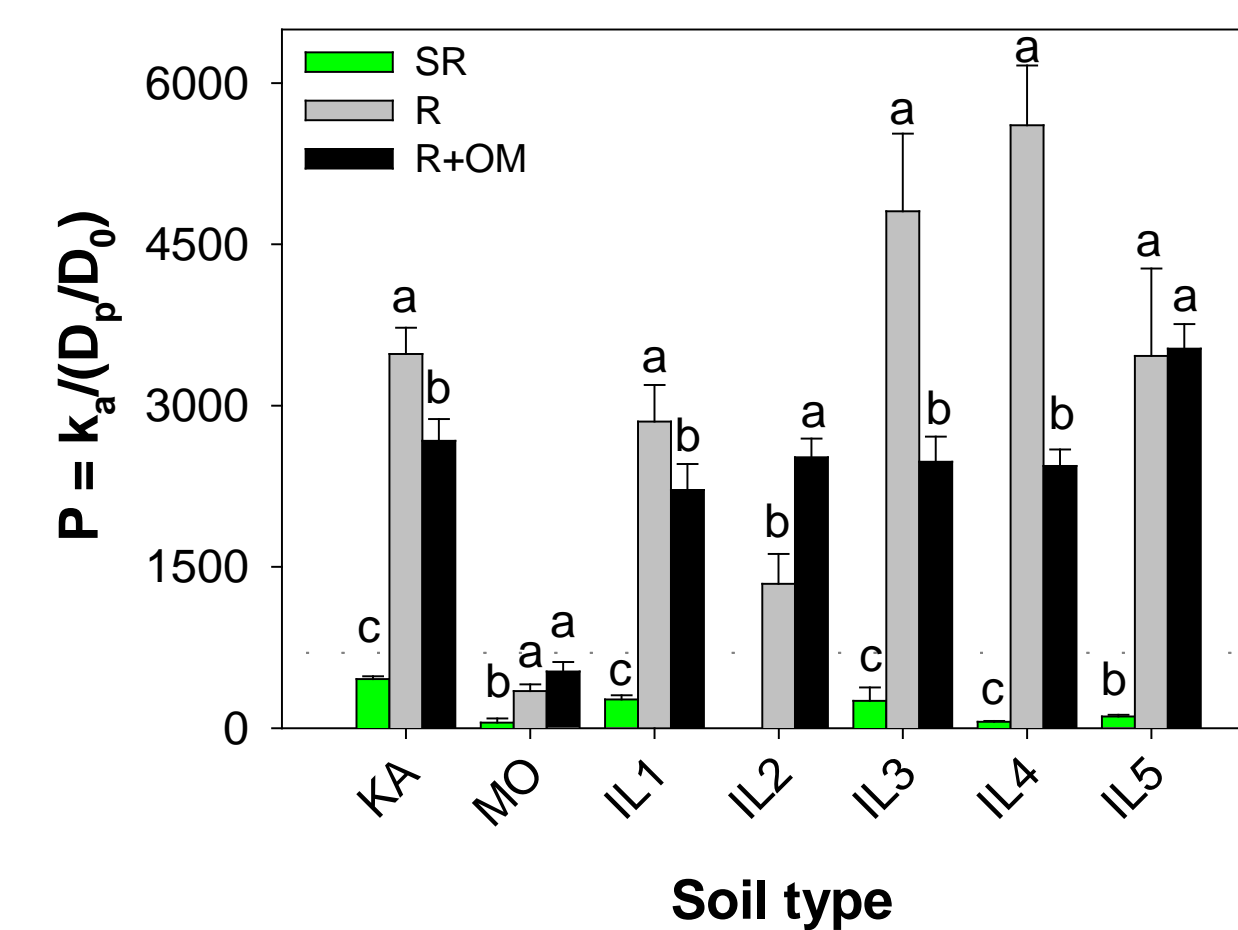
- Tensile strength (Y) for aggregates with volume (V)
- Friability (k) $\rightarrow \log_e(Y) = -k \times \log_e(V) + A$
- Characteristic strength (Y_4) $\rightarrow Y$ for 4-mm aggregate
- Soil workability (W) = $k \times (1/Y_4)$

Results

Incubation/Amendment effect on pore size fractions



Structure Complexity

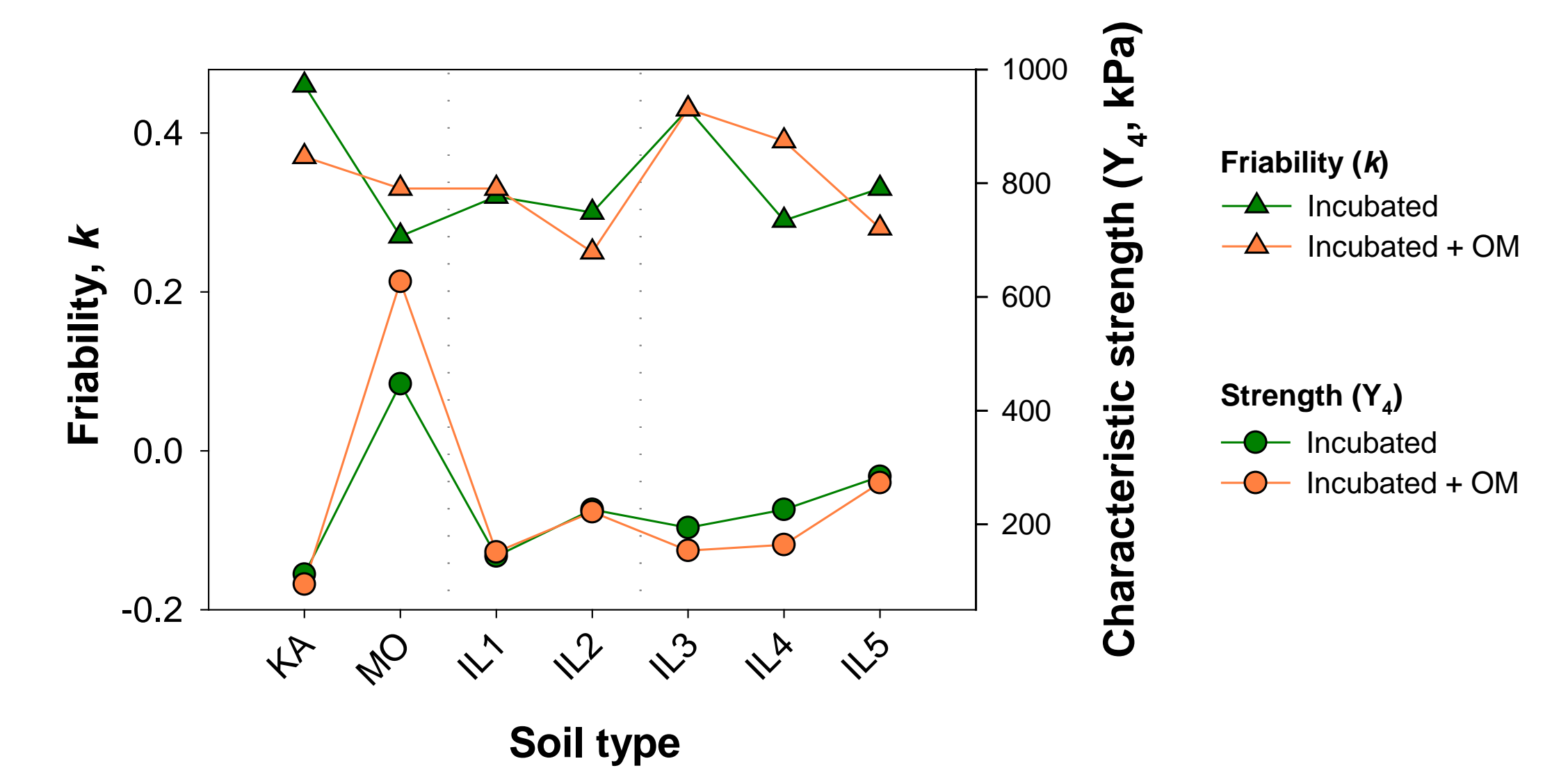


Incubation/Amendment effect on soil bulk density

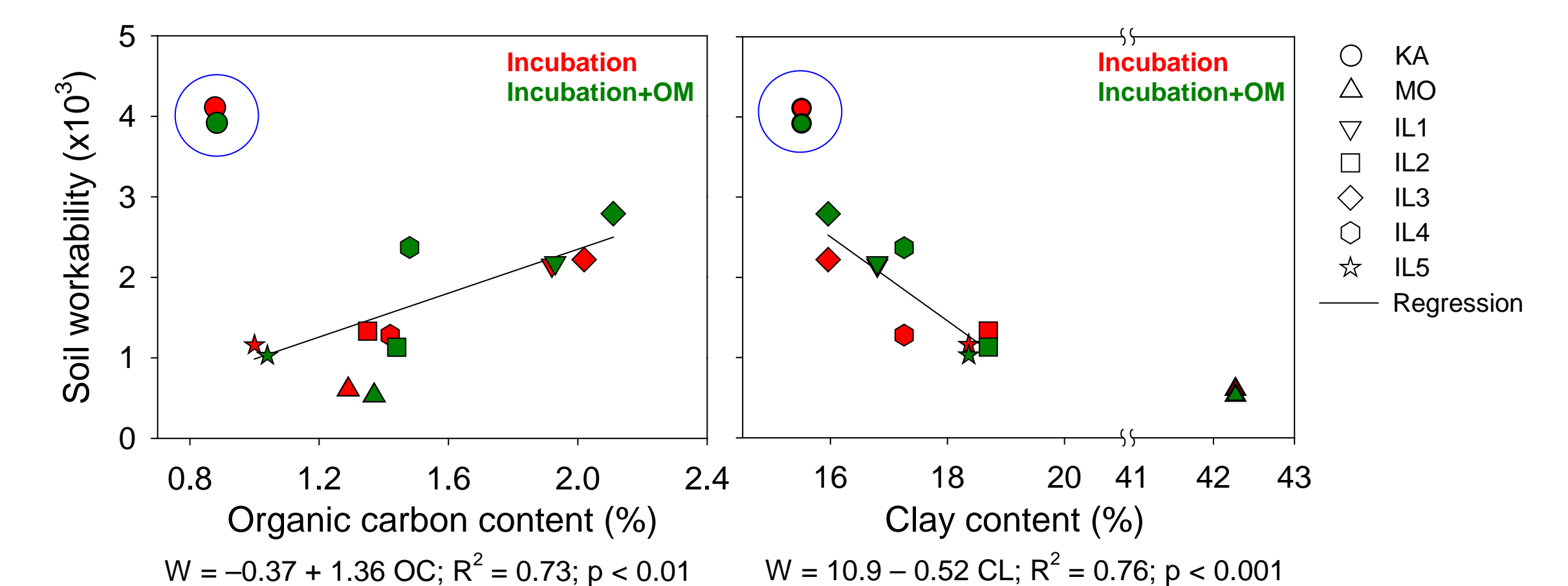
Soil	Sieved-repacked	Incubation	Incubation + OM
g cm ⁻³			
KA	1.38 ^a	1.21 ^b	1.16 ^b
MO	1.18 ^a	1.10 ^b	1.10 ^b
IL1	1.31 ^a	1.21 ^a	1.22 ^a
IL2	nd	1.42 ^a	1.29 ^b
IL3	1.26 ^a	1.05 ^b	1.11 ^b
IL4	1.38 ^a	1.15 ^b	1.20 ^b
IL5	1.44 ^a	1.17 ^b	1.23 ^b

Results

Friability and Strength of newly-formed aggregates



Workability of newly-developed structure - effect of clay content and organic carbon



Conclusions

Incubation of 2-mm sieved soils of varying mineralogy with organic amendment:

- Decreased bulk density and increased macroporosity (pores > 100 μm) and structural complexity
- Significant macro-aggregation in all soils
- Aggregate characteristics depended largely on clay mineralogy and native organic matter content
 - Soil strength: kaolinite < illite < smectite
 - Workability: greater with higher organic carbon
- Organic amendment had limited effect on structural development

Acknowledgments

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