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Prediction of biopore- and matrix-dominated flow from X-ray CT-derived macropore network characteristics

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Table S1: X-ray CT derived macropore network characteristics. Please note that while all 65 core samples extracted from the Silstrup field were scanned with the X-Tek HMX225 X-Ray CT scanner, for a few samples the obtained data quality did not allow for meaningful analysis. No data are shown for these samples. Bold numbers mark samples with at least one biopore connected from the top to the bottom.

Location	MP	PMP	EPMP	MPSSA	MPHR	MPMD	MPFD	MPGC	MPLC
	$m^3\ m^{-3}$	$m^3\ m^{-3}$	$m^3\ m^{-3}$	$mm^2\ mm^{-3}$	mm	mm	-	-	Euler no. mm^{-3}
1	0.080	0.069	0.042	0.235	0.376	1.31	2.37	0.86	0.75
2	0.037	0.023	0.010	0.155	0.298	0.76	2.27	0.62	0.14
3	**0.077**	**0.070**	**0.010**	**0.279**	**0.281**	**0.96**	**2.44**	**0.91**	**0.83**
4	0.041	0.031	0.005	0.222	0.192	0.57	2.36	0.76	0.55
5	0.074	0.065	0.013	0.232	0.356	1.10	2.35	0.88	0.79
6	**0.051**	**0.037**	**0.015**	**0.187**	**0.339**	**0.88**	**2.32**	**0.73**	**0.38**
7	0.08	0.088	0.026	0.318	0.303	1.02	2.48	1.10	0.88
8	**0.147**	**0.140**	**0.072**	**0.402**	**0.374**	**1.31**	**2.56**	**0.95**	**0.90**
9	0.040	0.015	0.001	0.157	0.182	0.75	2.21	0.38	0.22
10	**0.046**	**0.031**	**0.008**	**0.189**	**0.263**	**0.77**	**2.37**	**0.67**	**0.25**
11	0.059	0.050	0.032	0.209	0.303	1.06	2.36	0.85	0.71
12	0.040	0.024	0.021	0.168	0.218	0.75	2.33	0.60	0.19
13	0.071	0.053	0.029	0.234	0.267	0.75	2.40	0.75	0.76
14	0.043	0.024	0.002	0.185	0.284	0.81	2.31	0.56	0.28
15	0.106	0.101	0.044	0.348	0.299	0.95	2.49	0.95	0.92
16	0.035	0.024	0.001	0.166	0.209	0.58	2.29	0.69	0.46
17	0.081	0.073	0.024	0.312	0.268	0.83	2.49	0.90	0.82
18	0.060	0.044	0.025	0.283	0.221	0.57	2.47	0.73	0.53
19	**0.119**	**0.112**	**0.069**	**0.354**	**0.347**	**1.30**	**2.54**	**0.94**	**0.89**
20	**0.041**	**0.026**	**0.009**	**0.172**	**0.268**	**0.76**	**2.29**	**0.63**	**0.21**
21	**0.069**	**0.063**	**0.020**	**0.254**	**0.277**	**0.84**	**2.40**	**0.91**	**0.80**
22	**0.123**	**0.117**	**0.027**	**0.367**	**0.340**	**1.20**	**2.54**	**0.95**	**0.91**
23	**0.105**	**0.096**	**0.056**	**0.379**	**0.286**	**0.93**	**2.56**	**0.91**	**0.84**
24	0.114	0.104	0.056	0.380	0.317	1.13	2.54	0.91	0.84
25	0.06	0.051	0.021	0.276	0.218	0.70	2.47	0.85	0.73
26	0.045	0.052	0.007	0.284	0.240	0.71	2.51	0.80	0.63
27	0.078	0.066	0.019	0.252	0.333	1.08	2.44	0.85	0.68
28	**0.118**	**0.106**	**0.069**	**0.314**	**0.399**	**1.67**	**2.55**	**0.90**	**0.81**
29	0.073	0.051	0.009	0.309	0.239	0.72	2.58	0.69	0.61
30	0.09	0.081	0.041	0.284	0.334	1.23	2.48	0.90	0.81
31	0.043	0.026	0.012	0.190	0.236	0.69	2.39	0.60	0.10
32	0.061	0.053	0.013	0.311	0.198	0.56	2.50	0.87	0.73
33	0.04	0.020	0.007	0.269	0.275	0.50	2.43	0.50	0.66
34	0.078	0.067	0.035	0.329	0.241	0.71	2.57	0.86	0.74
35	0.093	0.085	0.031	0.340	0.282	0.89	2.56	0.91	0.83
36	0.068	0.061	0.019	0.241	0.287	0.92	2.38	0.90	0.79
37	-	-	-	-	-	-	-	-	-
38	-	-	-	-	-	-	-	-	-

39	-	-	-	-	-	-	-	-	-
40	0.057	0.043	0.014	0.199	0.298	1.12	2.33	0.75	0.14
41	**0.091**	**0.061**	**0.047**	**0.221**	**0.439**	**2.06**	**2.39**	**0.67**	**0.48**
42	-	-	-	-	-	-	-	-	-
43	0.059	0.048	-	0.262	0.235	0.71	2.46	0.81	0.66
44	-	-	-	-	-	-	-	-	-
45	0.040	0.015	0.001	0.158	0.361	0.80	2.32	0.38	0.11
46	**0.045**	**0.035**	**0.019**	**0.199**	**0.235**	**0.71**	**2.37**	**0.77**	**0.59**
47	0.047	0.041	0.014	0.187	0.251	0.77	2.26	0.87	0.67
48	0.048	-	0.019	0.295	0.397	0.55	2.53	-	0.70
49	0.057	0.048	0.009	0.24	0.240	0.73	2.42	0.84	0.71
50	**0.077**	**0.052**	**0.040**	**0.252**	**0.359**	**1.06**	**2.42**	**0.68**	**0.46**
51	-	-	-	-	-	-	-	-	-
52	-	-	-	-	-	-	-	-	-
53	**0.111**	**0.103**	**0.021**	**0.301**	**0.376**	**1.62**	**2.42**	**0.93**	**0.86**
54	0.085	0.081	0.036	0.369	0.241	0.74	2.50	0.95	0.91
55	-	-	-	-	-	-	-	-	-
56	0.088	0.080	0.048	0.376	0.233	0.70	2.56	0.91	0.84
57	0.047	0.040	0.006	0.304	0.254	0.71	2.35	0.85	0.98
58	**0.087**	**0.080**	**0.015**	**0.261**	**0.356**	**1.31**	**2.44**	**0.92**	**0.82**
59	0.055	0.040	0.015	0.220	0.265	0.76	2.37	0.73	0.59
60	0.067	0.061	0.003	0.218	0.317	1.12	2.35	0.91	0.83
61	0.035	0.015	0.009	0.270	0.221	0.61	2.37	0.43	0.69
62	0.041	0.020	0.004	0.172	0.295	0.74	2.33	0.50	0.14
63	0.071	0.055	0.017	0.231	0.339	1.11	2.37	0.77	0.62
64	0.076	0.061	0.040	0.279	0.299	0.89	2.46	0.80	0.64
65	**0.102**	**0.092**	**0.041**	**0.345**	**0.310**	**1.12**	**2.37**	**0.90**	**0.80**

MP is macroporosity, PMP is percolating macroporosity, EPMP is effective percolating macroporosity, MPSSA is macropore specific surface area, MPHR is macropore hydraulic radius, MPMD is macropore mean diameter, MPFD is macropore fractal dimension, MPGC is macropore global connectivity, MPLC is macropore local connectivity (for details see Figure 1).

Table S2: Soil texture and total carbon content for the samples extracted from the Silstrup field.

Location	Clay <2 µm	Silt 2-50µm	Sand 50-2000µm	Total carbon
-		g 100 g^{-1}		
1	14.8	30.4	51.4	2.05
2	14.9	29.7	52.0	2.02
3	14.2	30.3	52.1	2.06
4	14.3	30.9	51.4	2.03
5	14.2	30.4	52.0	2.01
6	14.9	30.9	50.8	2.03
7	14.9	31.0	50.6	2.02
8	14.3	31.2	51.1	2.00
9	14.9	28.8	52.9	2.11
10	15.0	30.4	51.4	2.00
11	15.0	31.5	50.1	2.03
12	15.1	29.4	52.1	2.02
13	15.4	30.6	50.5	1.99
14	15.6	31.0	50.0	2.02
15	15.0	28.0	53.5	2.09
16	15.0	31.5	50.0	2.11
17	14.3	33.4	49.0	2.04
18	14.4	29.1	53.0	2.07
19	14.3	32.2	50.4	1.90
20	14.3	29.3	53.1	1.90
21	14.4	31.6	50.6	2.03
22	14.3	29.3	53.0	1.98
23	14.4	32.2	50.1	1.94
24	15.0	28.8	53.0	1.92
25	15.0	31.8	50.0	1.91
26	14.4	29.7	52.4	2.13
27	14.3	31.6	50.8	1.98
28	15.0	30.8	50.8	2.07
29	16.2	29.1	51.3	2.01
30	15.4	30.9	50.4	1.91
31	16.9	29.0	50.4	2.16
32	16.9	31.5	48.0	2.20
33	16.1	28.2	52.3	2.08
34	16.1	30.0	50.5	1.98
35	16.1	29.8	50.8	1.95
36	18.9	32.4	45.0	2.17
37	17.6	30.3	48.5	2.11
38	16.8	31.9	48.0	1.96
39	16.1	29.9	50.8	1.89
40	16.7	30.0	49.8	2.08
41	18.9	32.5	45.4	1.91

42	18.3	29.0	49.7	1.83
43	17.6	31.9	47.1	2.01
44	17.0	28.9	50.8	1.98
45	16.2	29.9	50.8	1.81
46	16.9	31.5	48.4	1.83
47	16.9	28.8	51.1	1.82
48	17.0	31.9	47.7	2.05
49	16.2	29.0	51.4	1.96
50	16.8	29.7	50.7	1.70
51	18.5	30.4	48.2	1.77
52	14.6	32.1	50.4	1.75
53	16.1	28.7	52.0	1.89
54	16.2	27.8	52.7	1.94
55	16.9	29.4	50.7	1.75
56	18.9	29.8	48.0	1.87
57	16.8	29.8	50.2	1.82
58	14.6	23.3	59.0	1.84
59	16.6	25.9	54.1	1.95
60	17.5	28.3	51.4	1.71
61	15.6	28.0	52.9	2.06
62	15.5	30.6	50.6	1.93
63	17.6	31.4	47.7	1.94
64	16.2	28.0	52.5	1.81
65	16.2	28.8	52.2	1.73

Table S3: Measured macropore flow parameters for 65 core samples extracted from the Silstrup field. Bold numbers mark samples with at least one biopore connected from the top to the bottom.

Location	K_{sat} ($cm\ hr^{-1}$)	K_a at -30 cm (μm^2)	K_a at -100 cm (μm^2)	D_P/D_0 at -30 cm -	D_P/D_0 at -100 cm -	Total porosity -
1	8.06	4.37	7.98	3.2×10^{-3}	6.3×10^{-3}	0.45
2	0.14	0.35	0.67	3×10^{-3}	1.1×10^{-3}	0.45
3	**34.02**	**4.07**	**6.52**	$\mathbf{2.9 \times 10^{-3}}$	$\mathbf{5.4 \times 10^{-3}}$	**0.49**
4	0.00	0.19	0.49	3×10^{-4}	1.0×10^{-3}	0.45
5	0.77	0.69	5.30	2×10^{-4}	4.0×10^{-3}	0.45
6	**48.16**	**11.44**	**15.27**	$\mathbf{3.1 \times 10^{-3}}$	$\mathbf{4.6 \times 10^{-3}}$	**0.48**
7	0.56	2.51	5.30	1.7×10^{-3}	4.5×10^{-3}	0.49
8	**352.39**	**81.39**	**95.07**	$\mathbf{1.4 \times 10^{-2}}$	$\mathbf{2.2 \times 10^{-2}}$	**0.55**
9	0.18	0.12	0.35	1.0×10^{-4}	3.0×10^{-4}	0.45
10	**53.55**	**11.13**	**13.66**	$\mathbf{2.5 \times 10^{-3}}$	$\mathbf{4.4 \times 10^{-3}}$	**0.45**
11	0.77	1.73	2.91	1.7×10^{-3}	4.9×10^{-3}	0.47
12	0.39	0.48	0.97	5×10^{-4}	1.4×10^{-3}	0.45
13	0.49	3.07	6.52	2.8×10^{-3}	5.7×10^{-3}	0.48
14	0.04	0.03	0.24	1×10^{-4}	5×10^{-4}	0.42
15	4.05	3.34	8.06	3.1×10^{-3}	5.7×10^{-3}	0.48
16	0.04	0.05	0.49	1.0×10^{-4}	1.1×10^{-3}	0.43
17	1.02	3.73	8.67	2.7×10^{-3}	6.0×10^{-3}	0.50
18	0.28	0.60	2.63	7.0×10^{-4}	3.8×10^{-3}	0.46
19	**418.21**	**109.19**	**151.10**	$\mathbf{1.8 \times 10^{-2}}$	$\mathbf{2.5 \times 10^{-2}}$	**0.53**
20	**18.08**	**3.79**	**6.14**	$\mathbf{1.3 \times 10^{-3}}$	$\mathbf{3.5 \times 10^{-3}}$	**0.46**
21	**77.75**	**13.58**	**14.81**	$\mathbf{2.6 \times 10^{-3}}$	$\mathbf{3.5 \times 10^{-3}}$	**0.50**
22	**56.08**	**13.97**	**24.56**	$\mathbf{6.1 \times 10^{-3}}$	$\mathbf{1.0 \times 10^{-2}}$	**0.52**
23	**288.04**	**53.72**	**74.45**	$\mathbf{9.9 \times 10^{-3}}$	$\mathbf{1.2 \times 10^{-2}}$	**0.50**
24	6.12	6.06	10.67	3.7×10^{-3}	8.2×10^{-3}	0.53
25	1.23	1.65	3.91	1.4×10^{-3}	4.5×10^{-3}	0.48
26	0.07	0.65	1.46	6.0×10^{-4}	2.0×10^{-3}	0.49
27	6.65	3.91	7.29	2.9×10^{-3}	6.7×10^{-3}	0.49
28	**186.64**	**70.99**	**65.62**	$\mathbf{1.2 \times 10^{-2}}$	$\mathbf{1.4 \times 10^{-2}}$	**0.53**
29	3.13	4.53	9.21	2.9×10^{-3}	6.5×10^{-3}	0.50
30	2.22	1.85	2.66	1.9×10^{-3}	3.1×10^{-3}	0.48
31	0.81	1.57	2.14	1.3×10^{-3}	3.2×10^{-3}	0.46
32	0.28	0.84	1.99	7.0×10^{-4}	2.8×10^{-3}	0.48
33	0.04	0.04	0.19	1.0×10^{-4}	8.0×10^{-4}	0.47
34	0.77	3.44	5.53	2.8×10^{-3}	6.6×10^{-3}	0.51
35	6.30	7.21	14.35	4.3×10^{-3}	9.3×10^{-3}	0.51
36	5.49	1.73	2.60	1.2×10^{-3}	2.2×10^{-3}	0.47
37	2.43	3.54	6.68	3.5×10^{-3}	7.2×10^{-3}	0.49
38	1.37	2.63	4.45	1.9×10^{-3}	4.0×10^{-3}	0.48
39	**125.67**	**20.72**	**23.02**	$\mathbf{2.5 \times 10^{-3}}$	$\mathbf{4.1 \times 10^{-3}}$	**0.47**

40	1.23	5.22	8.21	2.8×10^{-3}	4.6×10^{-3}	0.46
41	**317.91**	**81.39**	**84.10**	$\mathbf{6.0 \times 10^{-3}}$	$\mathbf{8.3 \times 10^{-3}}$	**0.48**
42	9.36	3.80	4.99	1.6×10^{-3}	2.8×10^{-3}	0.45
43	1.20	3.66	6.29	1.6×10^{-3}	3.4×10^{-3}	0.47
44	24.98	8.06	10.74	2.4×10^{-3}	4.4×10^{-3}	0.48
45	0.04	0.14	0.66	4.0×10^{-4}	1.2×10^{-3}	0.45
46	**76.35**	**10.51**	**13.05**	$\mathbf{2.4 \times 10^{-3}}$	$\mathbf{3.1 \times 10^{-3}}$	**0.45**
47	1.16	0.37	0.78	4.0×10^{-3}	1.0×10^{-3}	0.44
48	0.14	1.75	2.86	1.3×10^{-3}	3.3×10^{-3}	0.50
49	0.53	0.43	1.25	1.0×10^{-5}	1.2×10^{-5}	0.45
50	**190.48**	**29.55**	**36.07**	$\mathbf{6.3 \times 10^{-3}}$	$\mathbf{8.1 \times 10^{-3}}$	**0.47**
51	0.04	0.19	0.45	2.0×10^{-4}	6.0×10^{-4}	0.44
52	1.37	0.92	2.38	1.1×10^{-3}	5.1×10^{-3}	0.43
53	**132.04**	**27.25**	**47.20**	$\mathbf{6.3 \times 10^{-3}}$	$\mathbf{8.6 \times 10^{-3}}$	**0.50**
54	0.67	2.57	4.53	1.9×10^{-3}	4.5×10^{-3}	0.48
55	0.46	0.59	1.08	7.0×10^{-4}	2.4×10^{-3}	0.45
56	9.18	5.30	16.50	3.9×10^{-4}	1.2×10^{-3}	0.47
57	0.04	0.25	0.73	4.0×10^{-4}	1.2×10^{-3}	0.45
58	**56.08**	**13.81**	**24.56**	$\mathbf{3.3 \times 10^{-3}}$	$\mathbf{5.4 \times 10^{-3}}$	**0.48**
59	0.99	1.56	2.29	1.3×10^{-3}	3.0×10^{-3}	0.45
60	5.45	0.16	0.43	3.0×10^{-4}	9.0×10^{-4}	0.45
61	0.04	0.05	0.94	4.0×10^{-4}	1.9×10^{-3}	0.44
62	0.11	0.55	2.14	5.0×10^{-4}	3.7×10^{-3}	0.47
63	5.03	1.39	2.11	9.0×10^{-4}	2.7×10^{-3}	0.48
64	0.99	0.72	1.61	8.0×10^{-4}	2.4×10^{-3}	0.50
65	**61.71**	**13.66**	**20.72**	$\mathbf{5.2 \times 10^{-3}}$	$\mathbf{1.1 \times 10^{-2}}$	**0.51**