

A. Appendix 1

Image templates of colored particles used for processing by image analysis software “ImageJ”. Photographs are followed by lithic clast and melt particle templates detected from FBN73, Enkingen, Wörnitzostheim, and Otting drill core. The drill core photographs and templates are sorted according to plane surface of half cores (depth characterizes the upper edge of each piece; scale is given for each photograph), thin sections (picture length = 3.4 cm), secondary electron (SE) pictures (picture width = 0.7 mm).

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Fig. A.1.: Half core photographs of FBN73 (300.9 - 329.7 m)

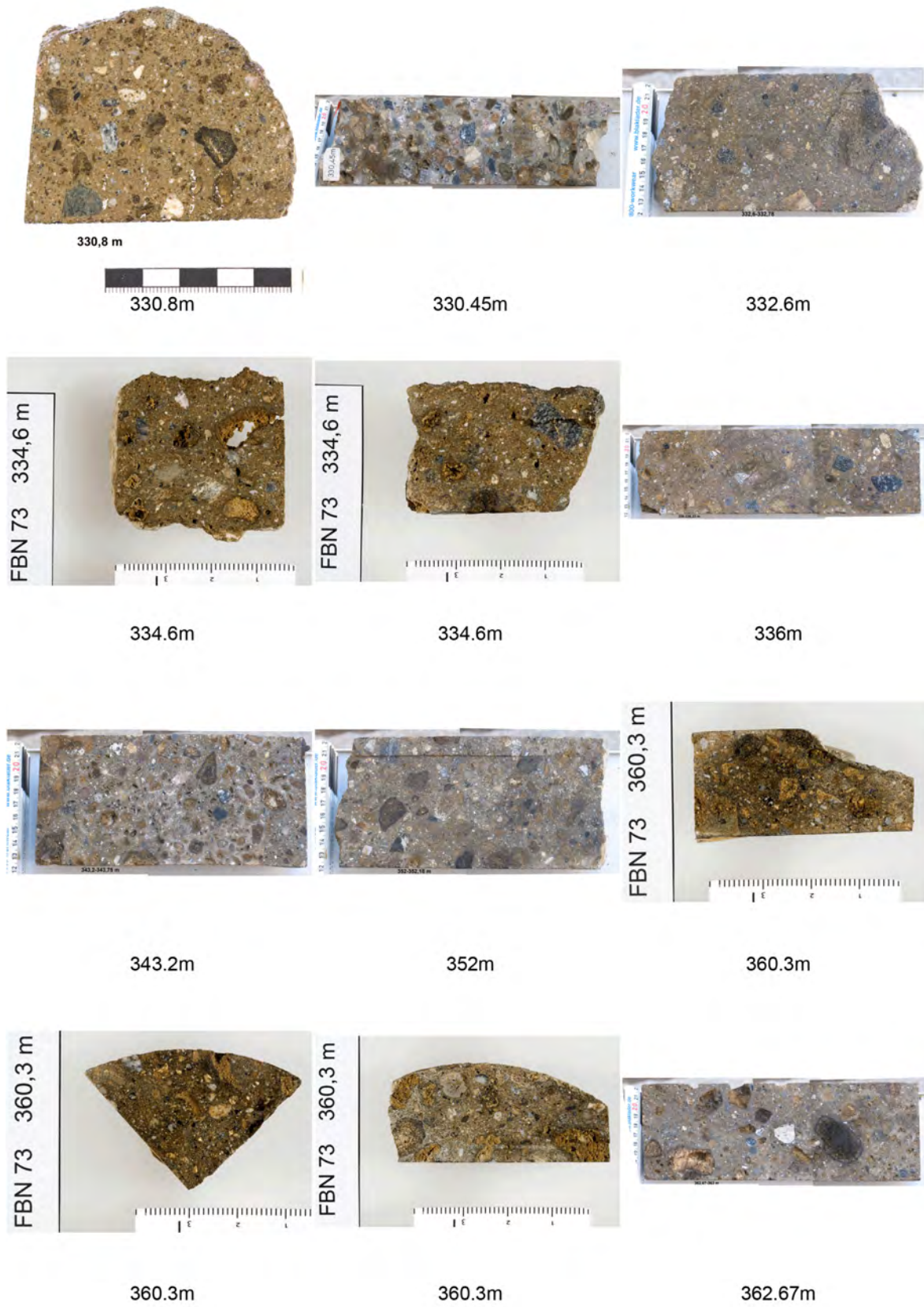


Fig. A.2.: Half core photographs of FBN73 (330.8 - 362.67 m)

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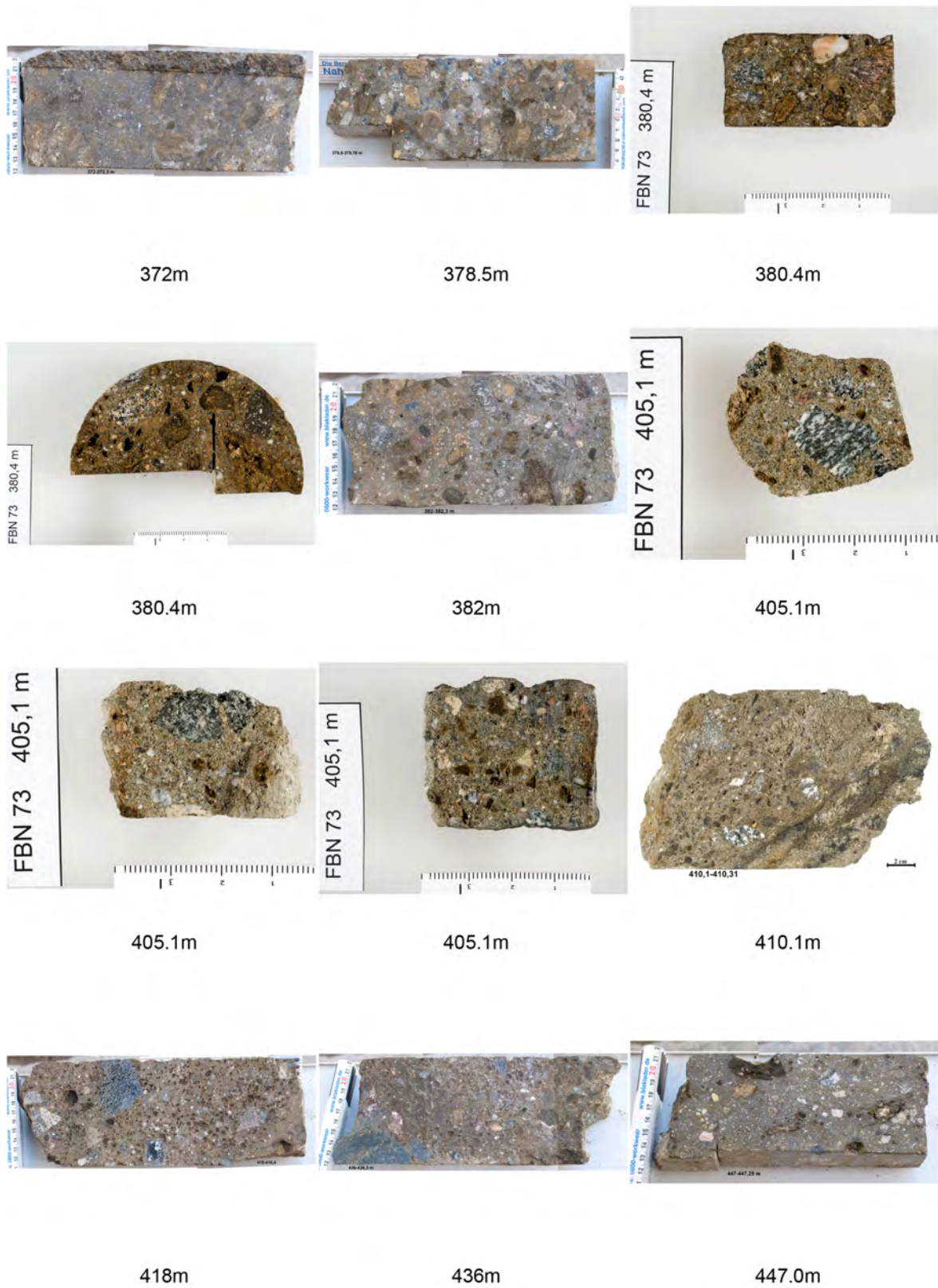


Fig. A.3.: Half core photographs of FBN73 (372 - 447 m)

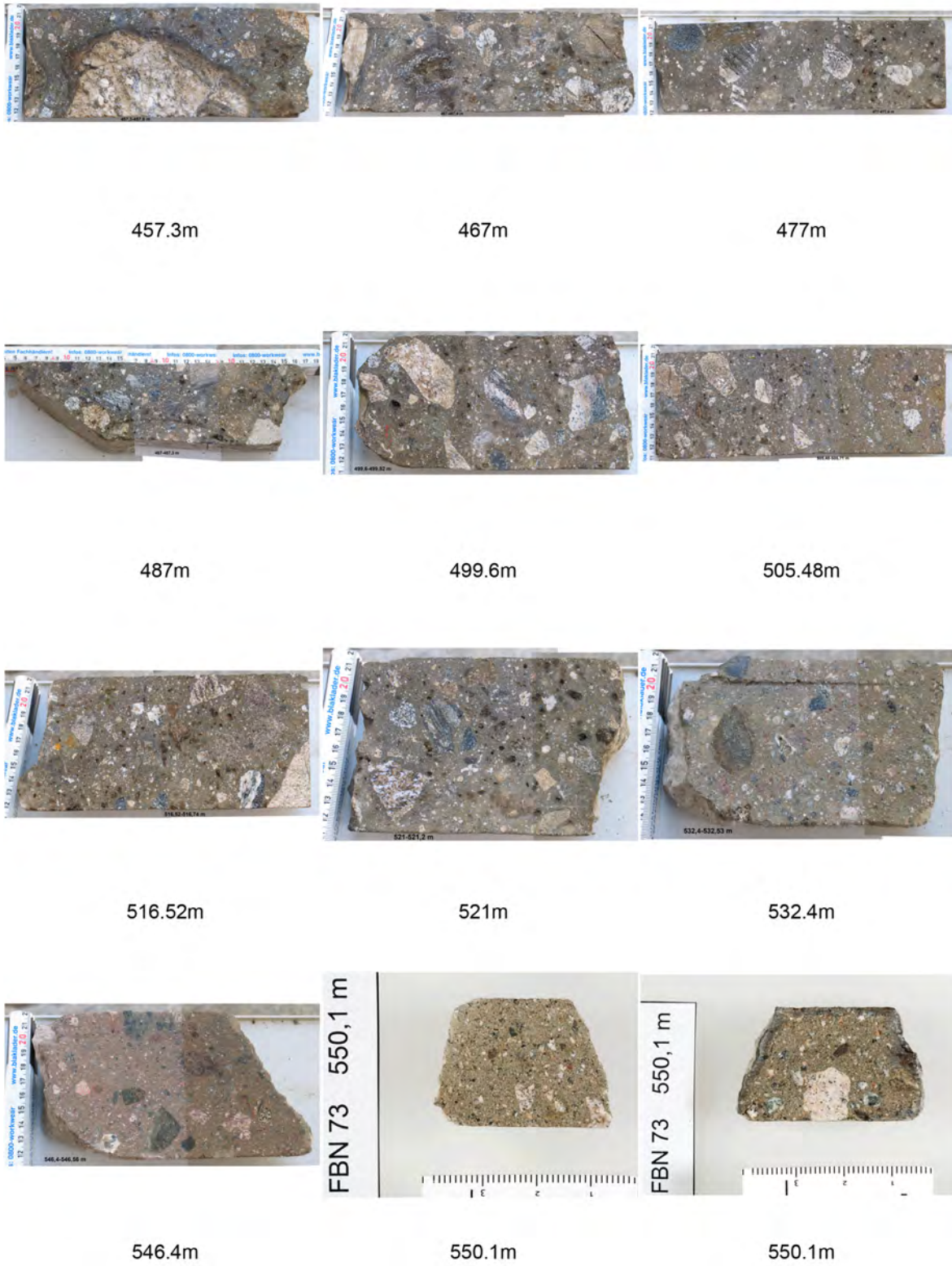


Fig. A.4.: Half core photographs of FBN73 (457.3 - 550.1 m)

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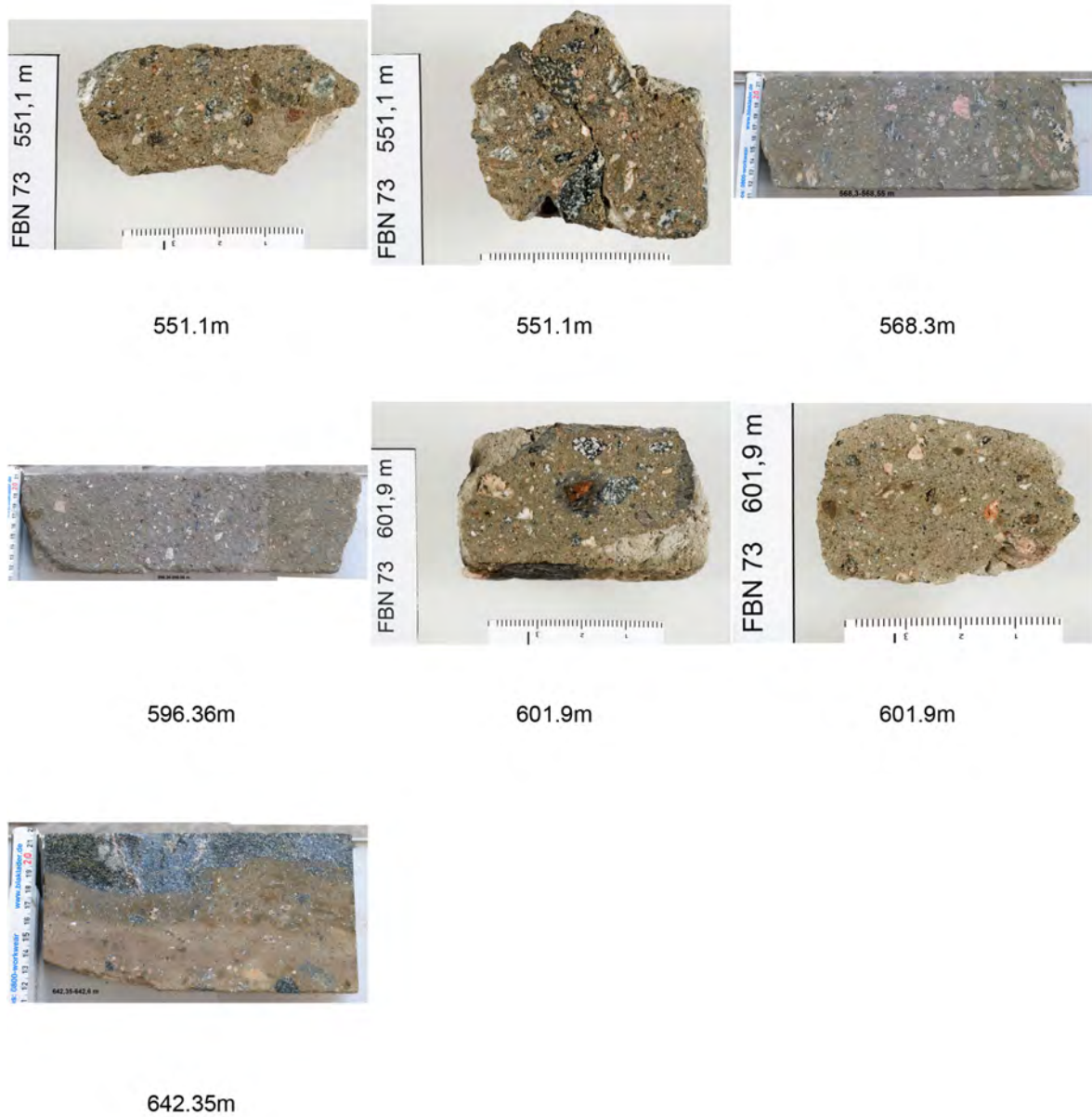


Fig. A.5.: Half core photographs of FBN73 (551.1 - 642.35 m)

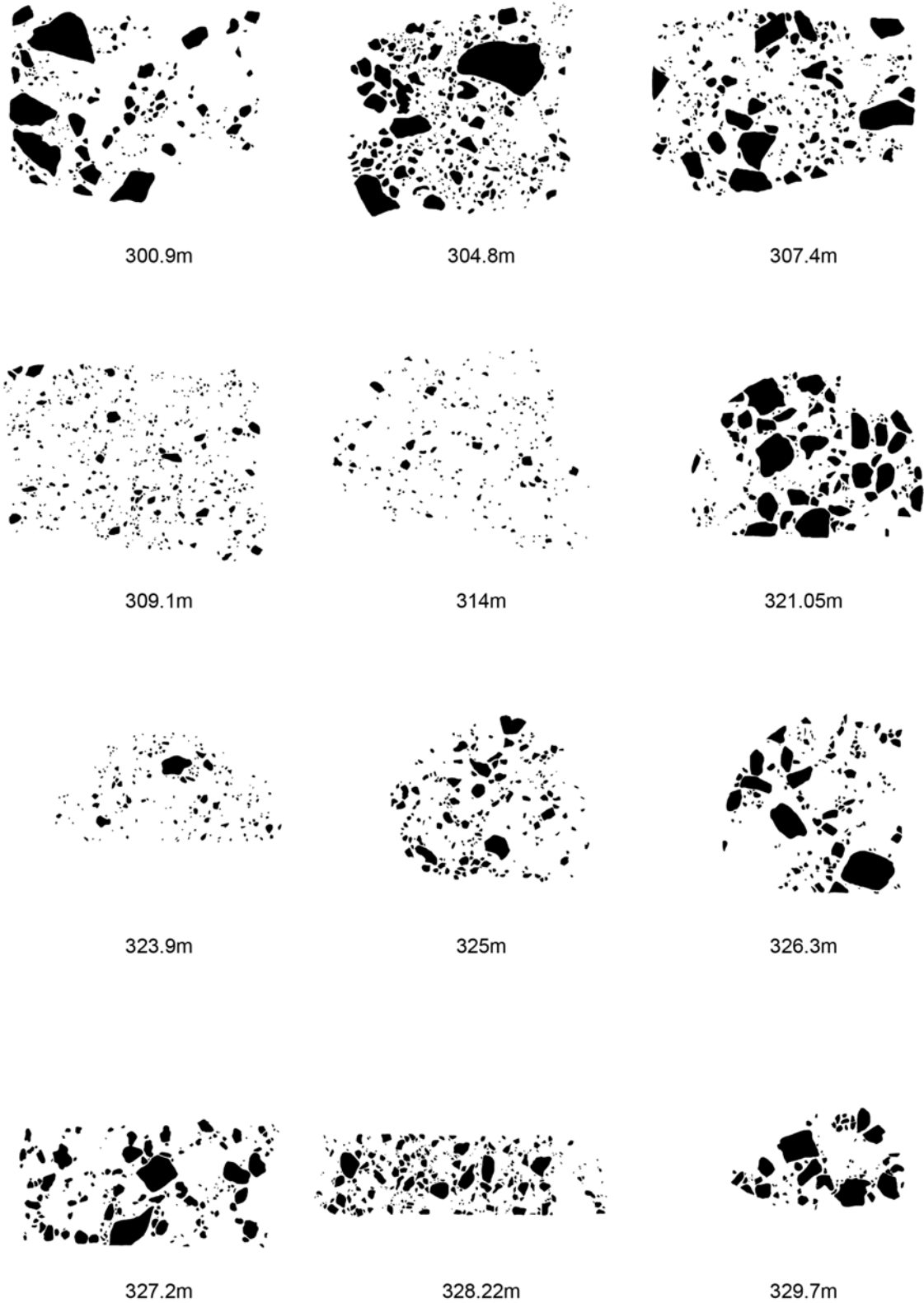


Fig. A.6.: Half core templates of FBN73 (lithic clasts 300.9 - 329.7 m)

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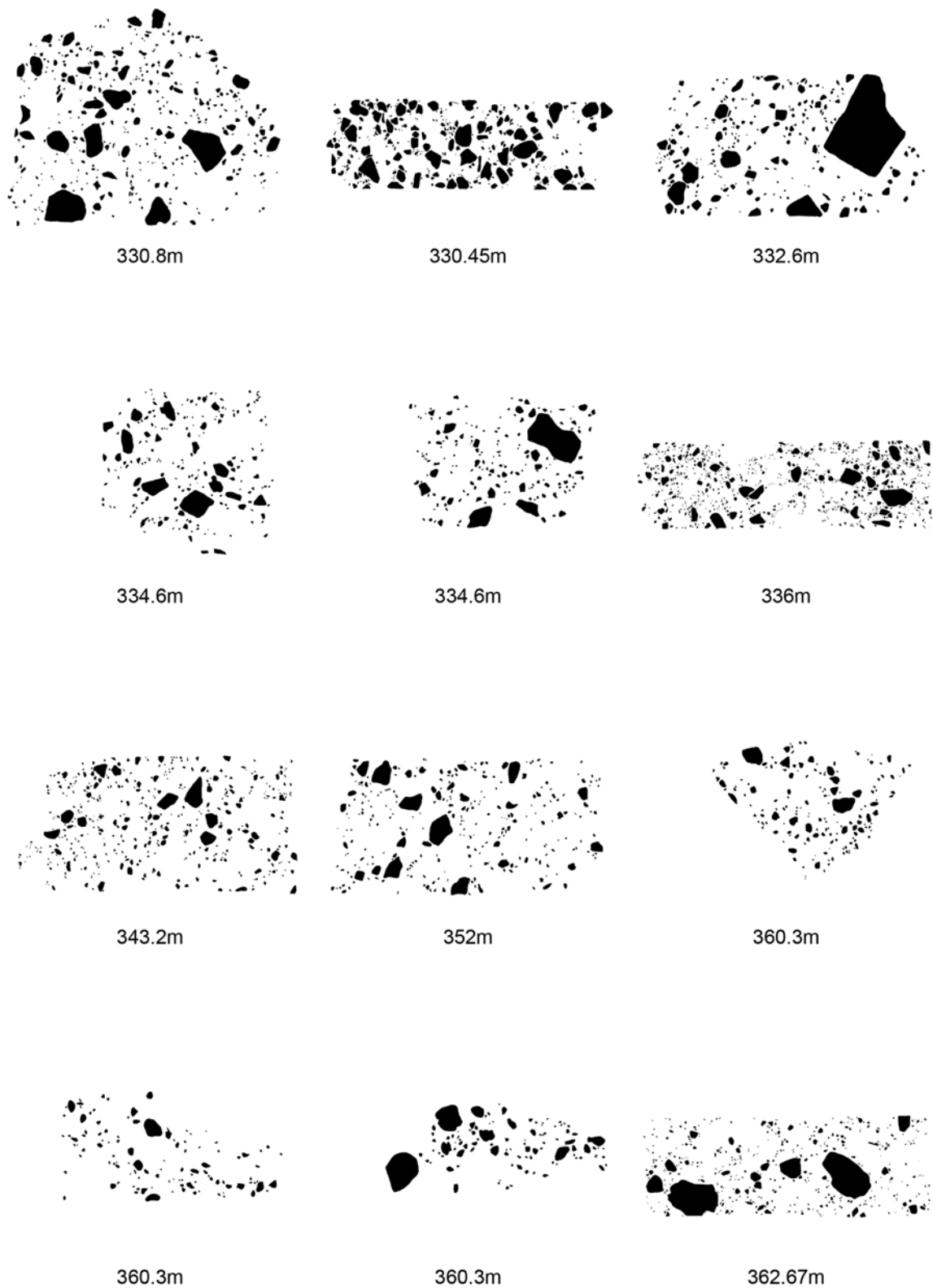


Fig. A.7.: Half core templates of FBN73 (lithic clasts 330.8 - 362.67 m)

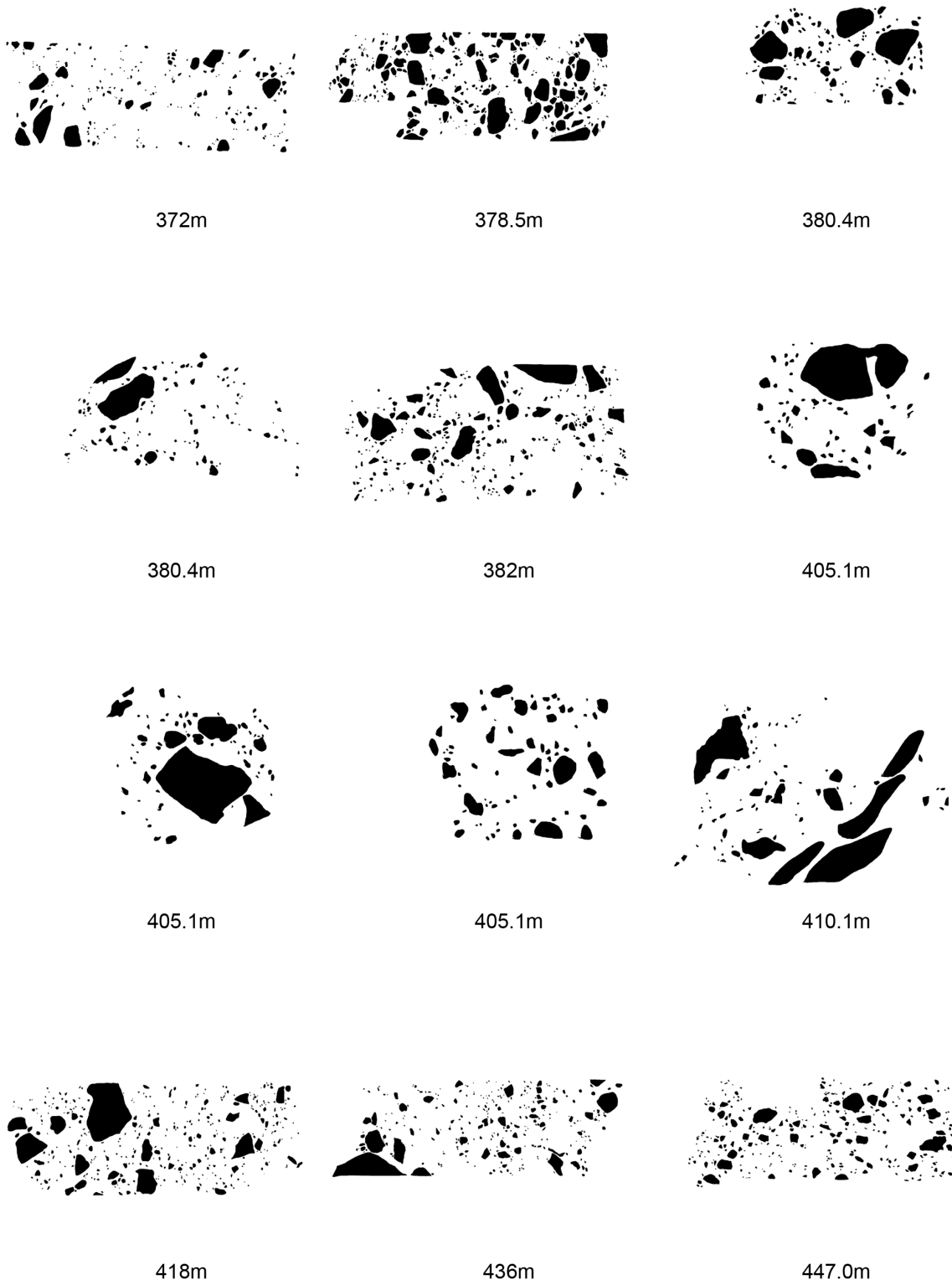


Fig. A.8.: Half core templates of FBN73 (lithic clasts 372 - 447 m)

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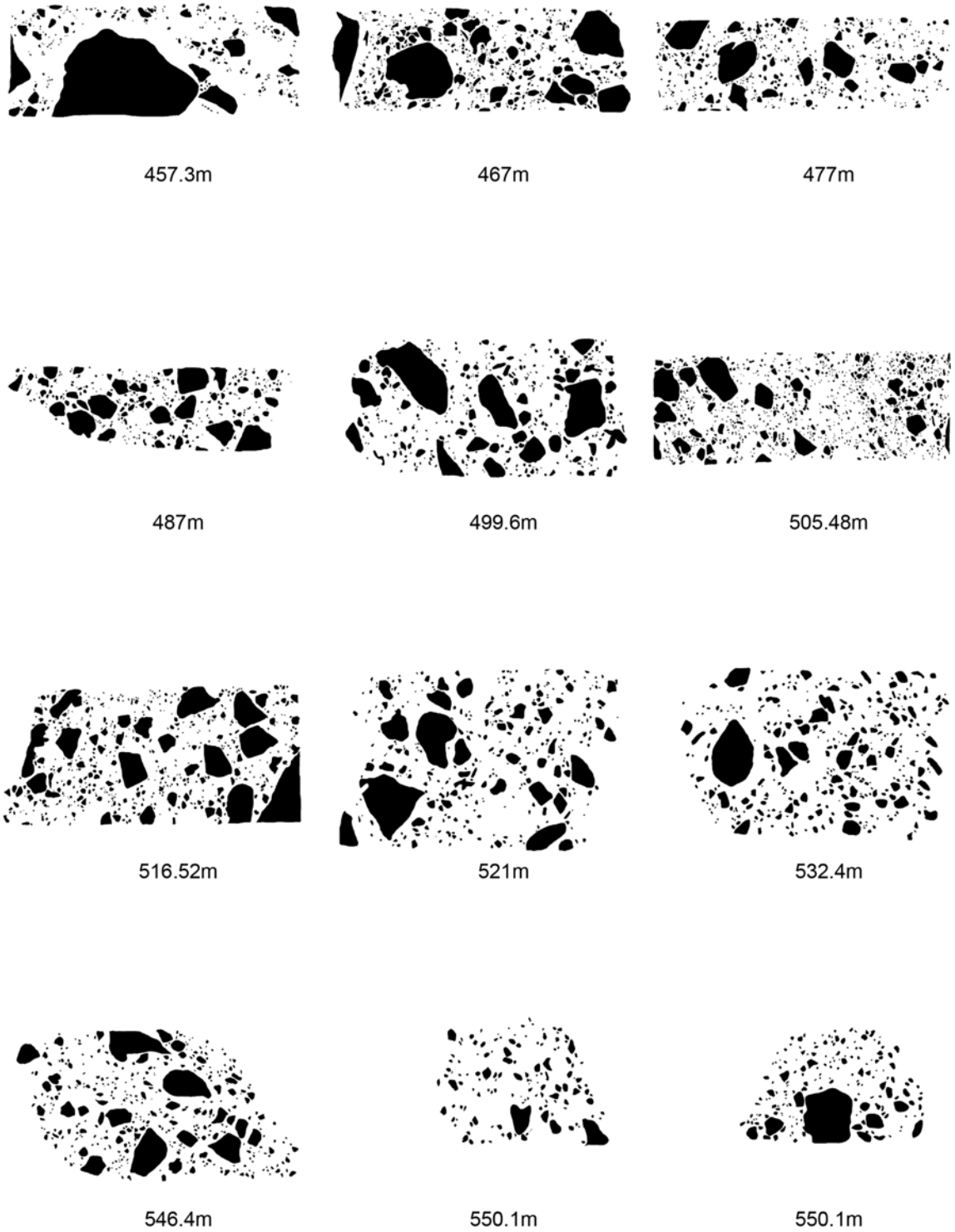


Fig. A.9.: Half core templates of FBN73 (lithic clasts 457.3 - 550.1 m)

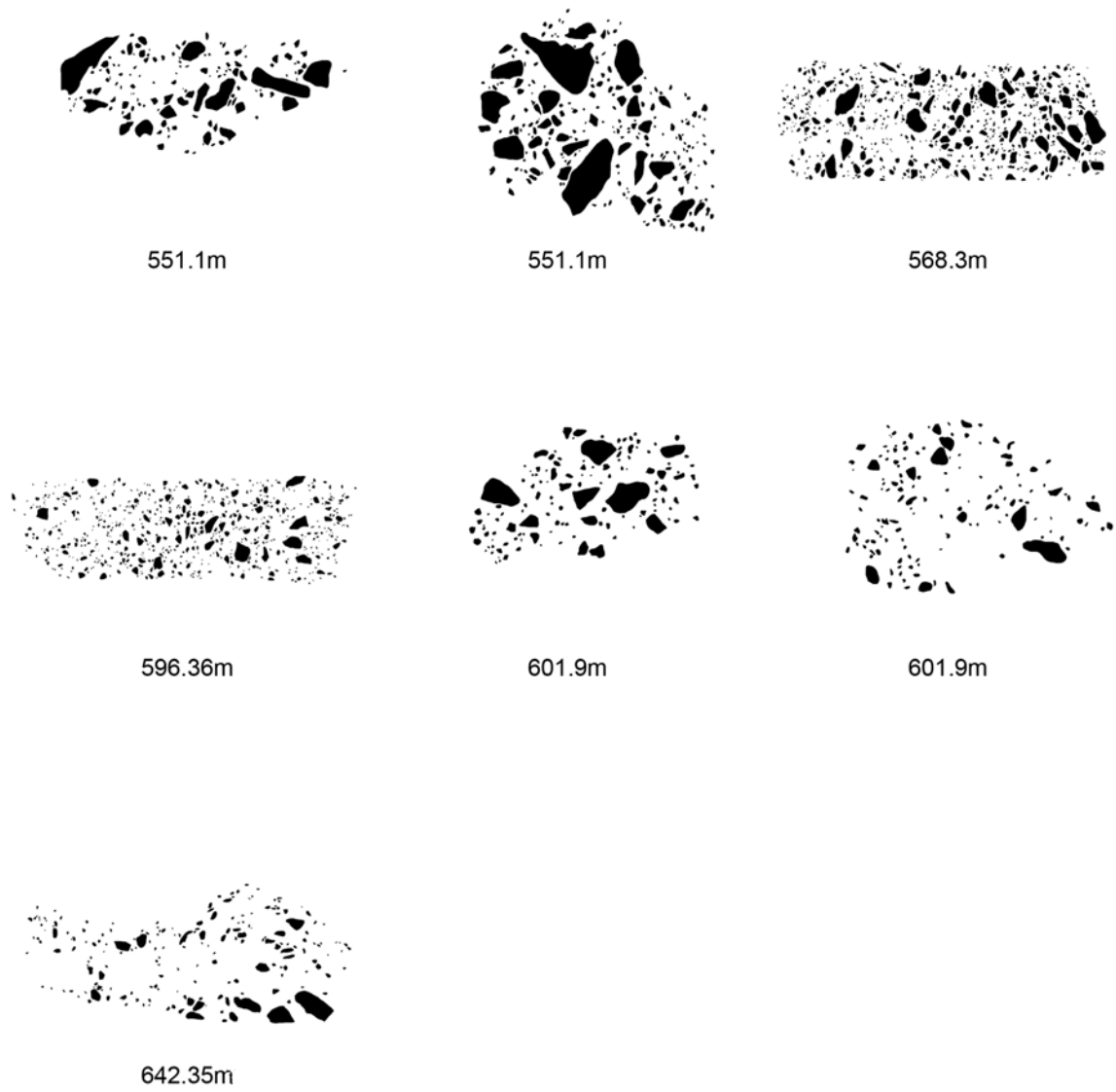


Fig. A.10.: Half core templates of FBN73 (lithic clasts 551.1 - 642.35 m)

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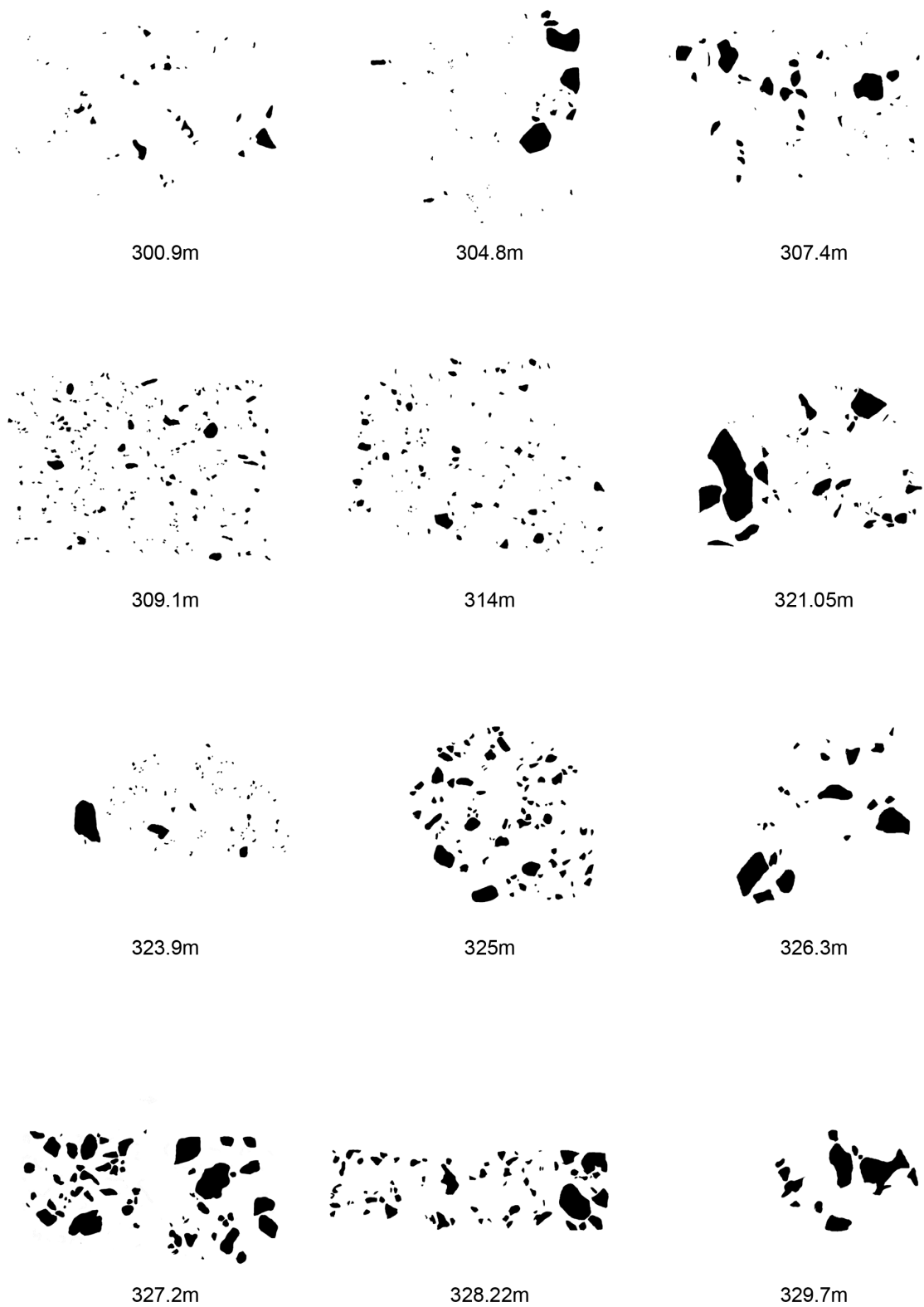


Fig. A.11.: Half core templates of FBN73 (melt particles 300.9 - 329.7 m)

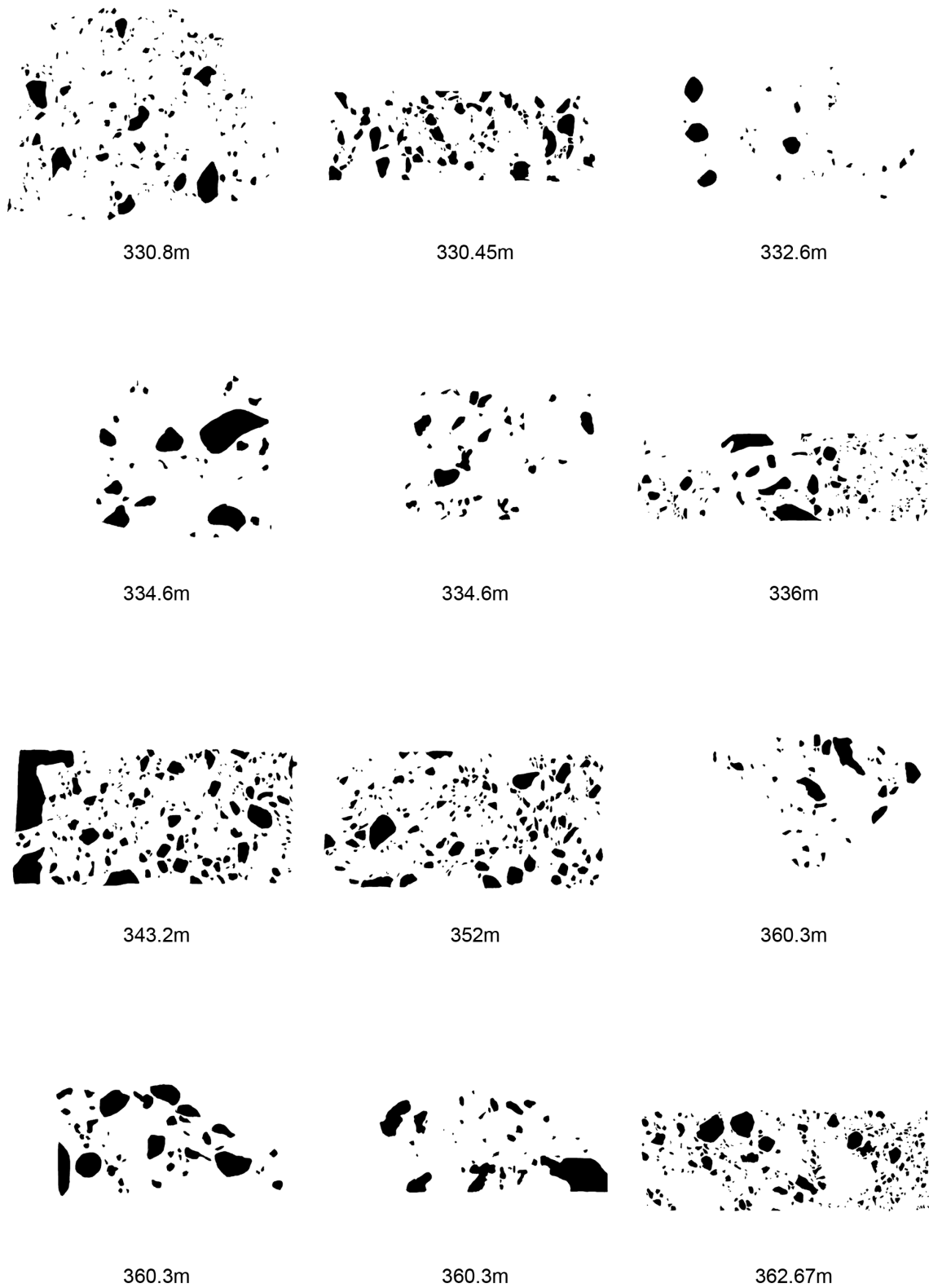


Fig. A.12.: Half core templates of FBN73 (melt particles 330.8 - 362.67 m)

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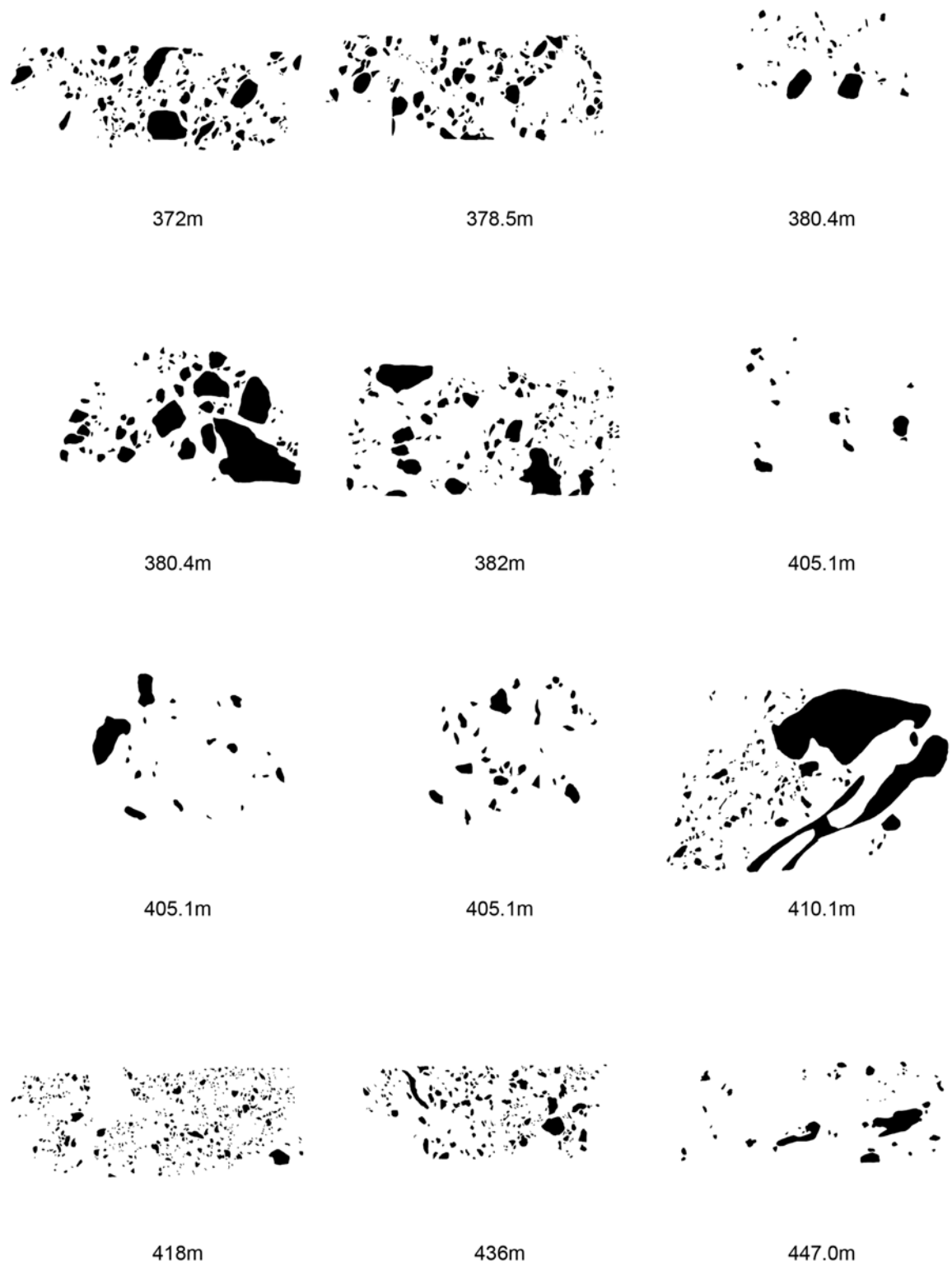


Fig. A.13.: Half core templates of FBN73 (melt particles 372 - 447 m)

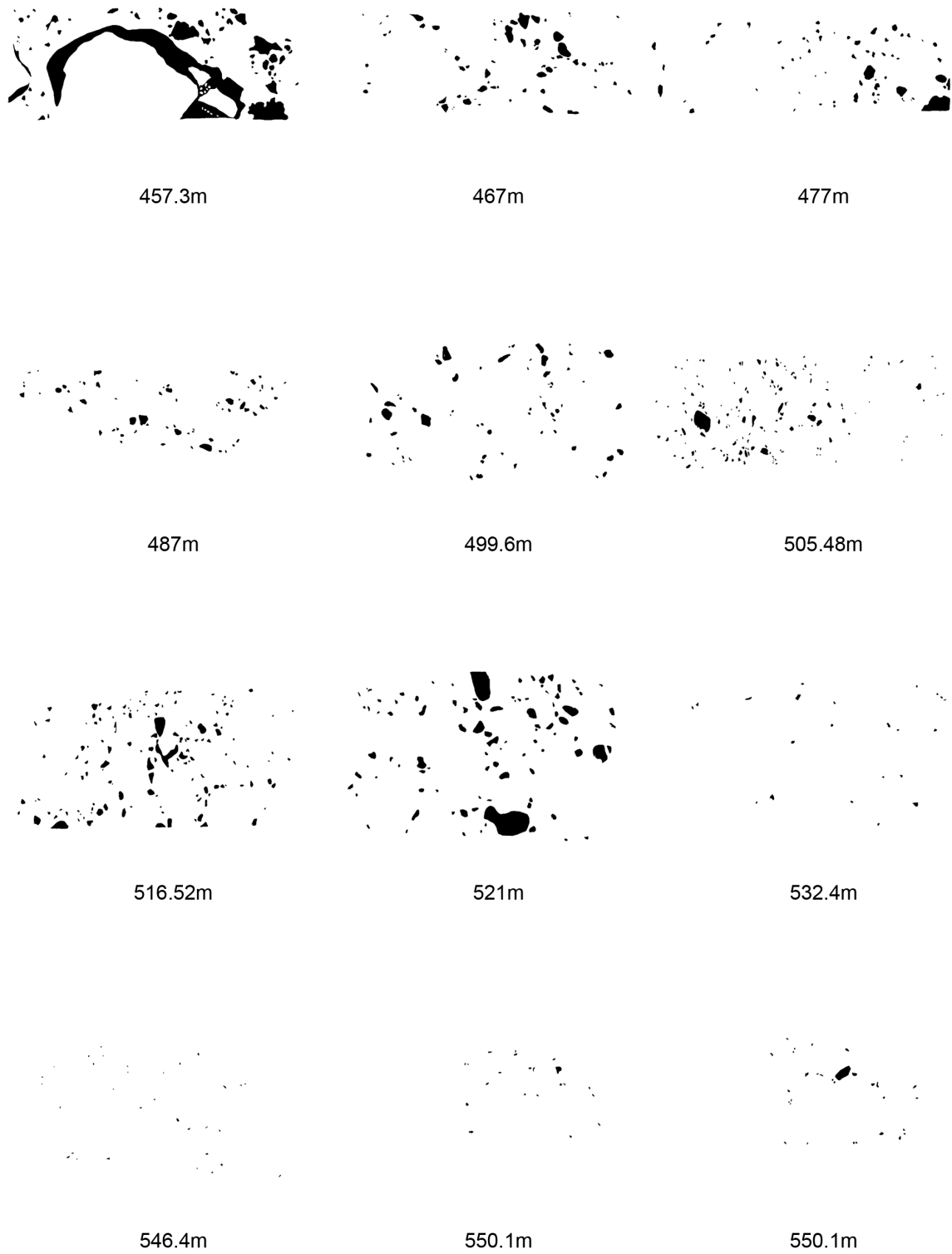


Fig. A.14.: Half core templates of FBN73 (melt particles 457.3 - 550.1 m)

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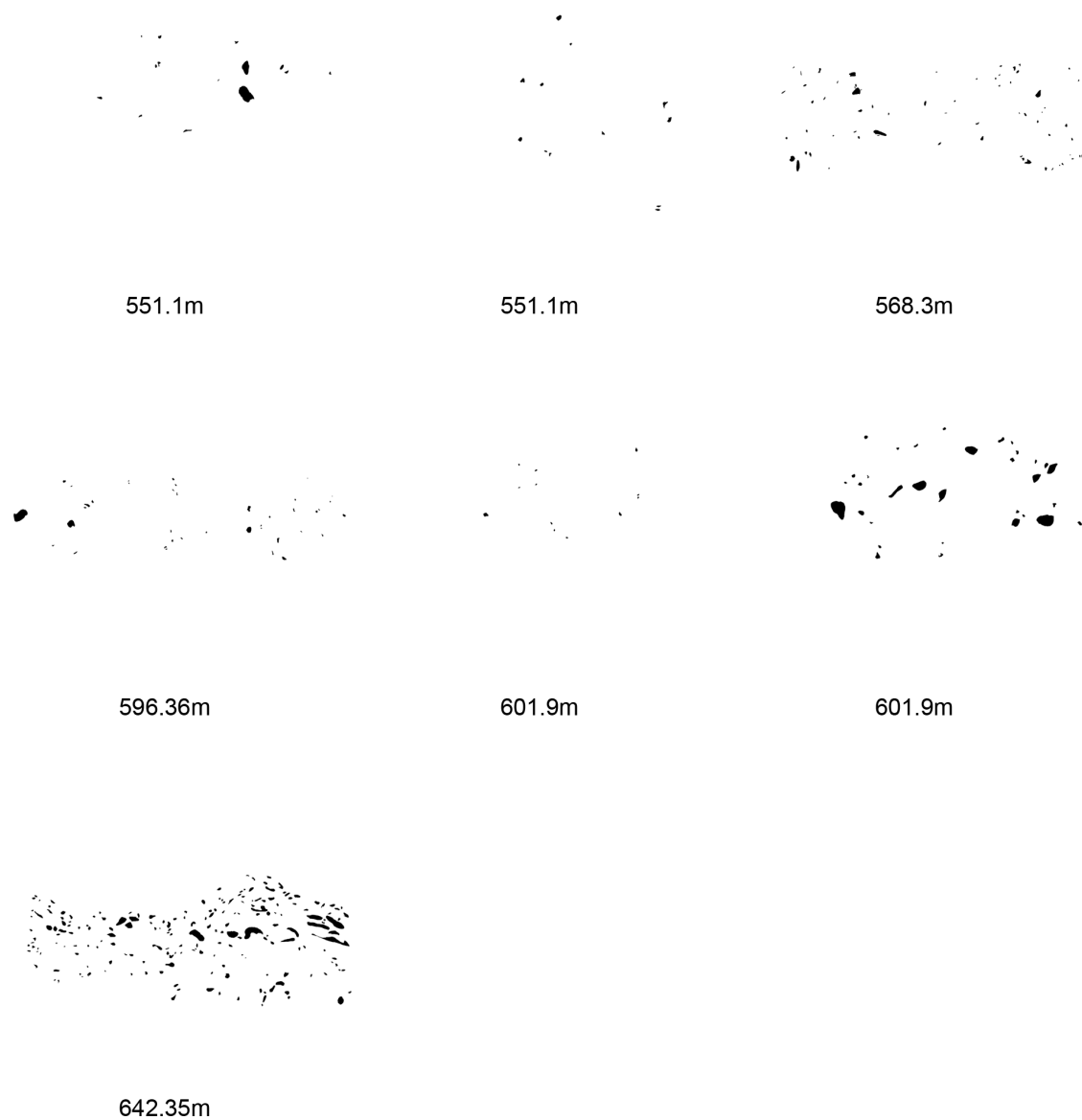


Fig. A.15.: Half core templates of FBN73 (melt particles 551.1 - 642.35 m)

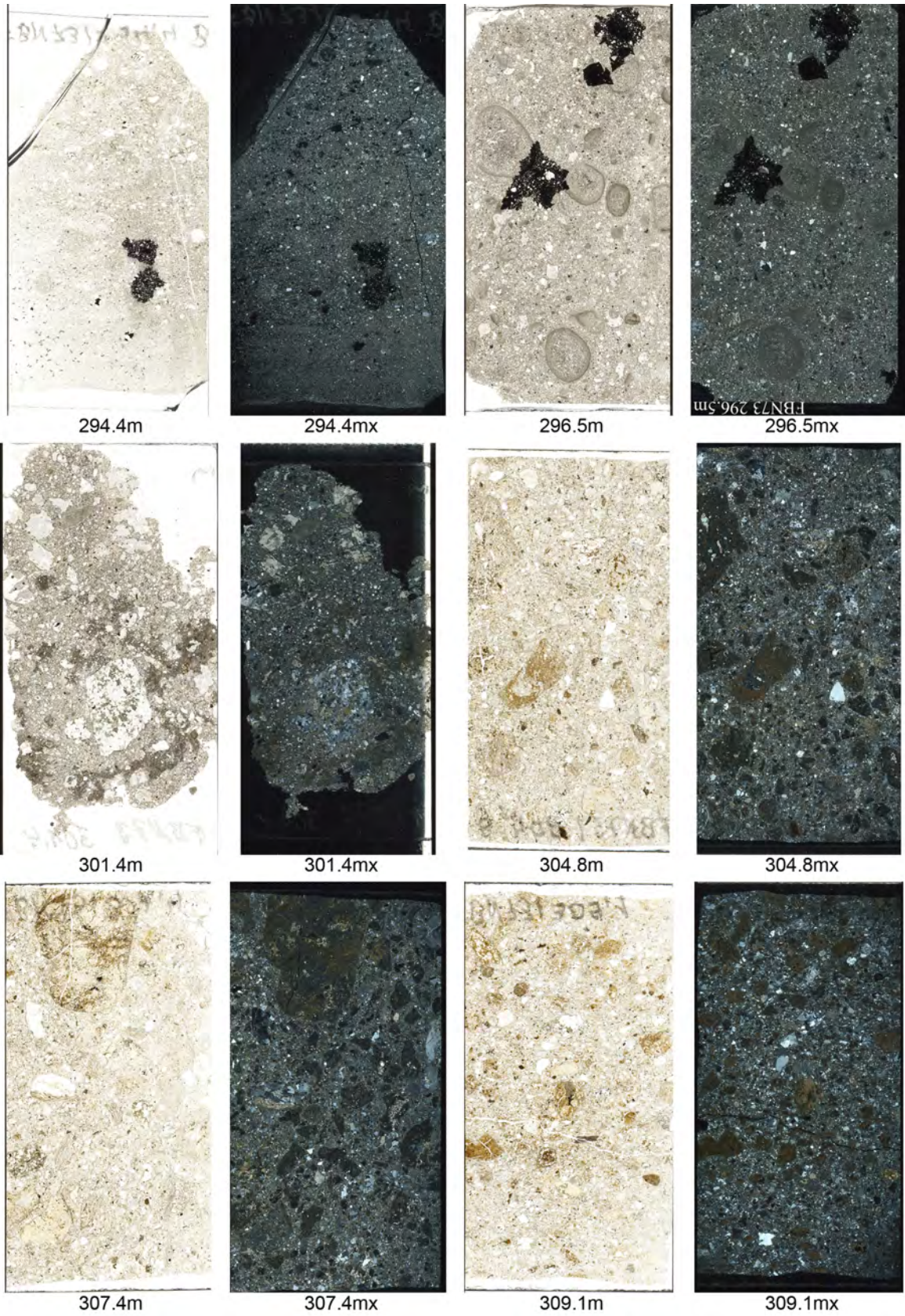


Fig. A.16.: Thin section photographs of FBN73 (294.4 - 309.1 m)

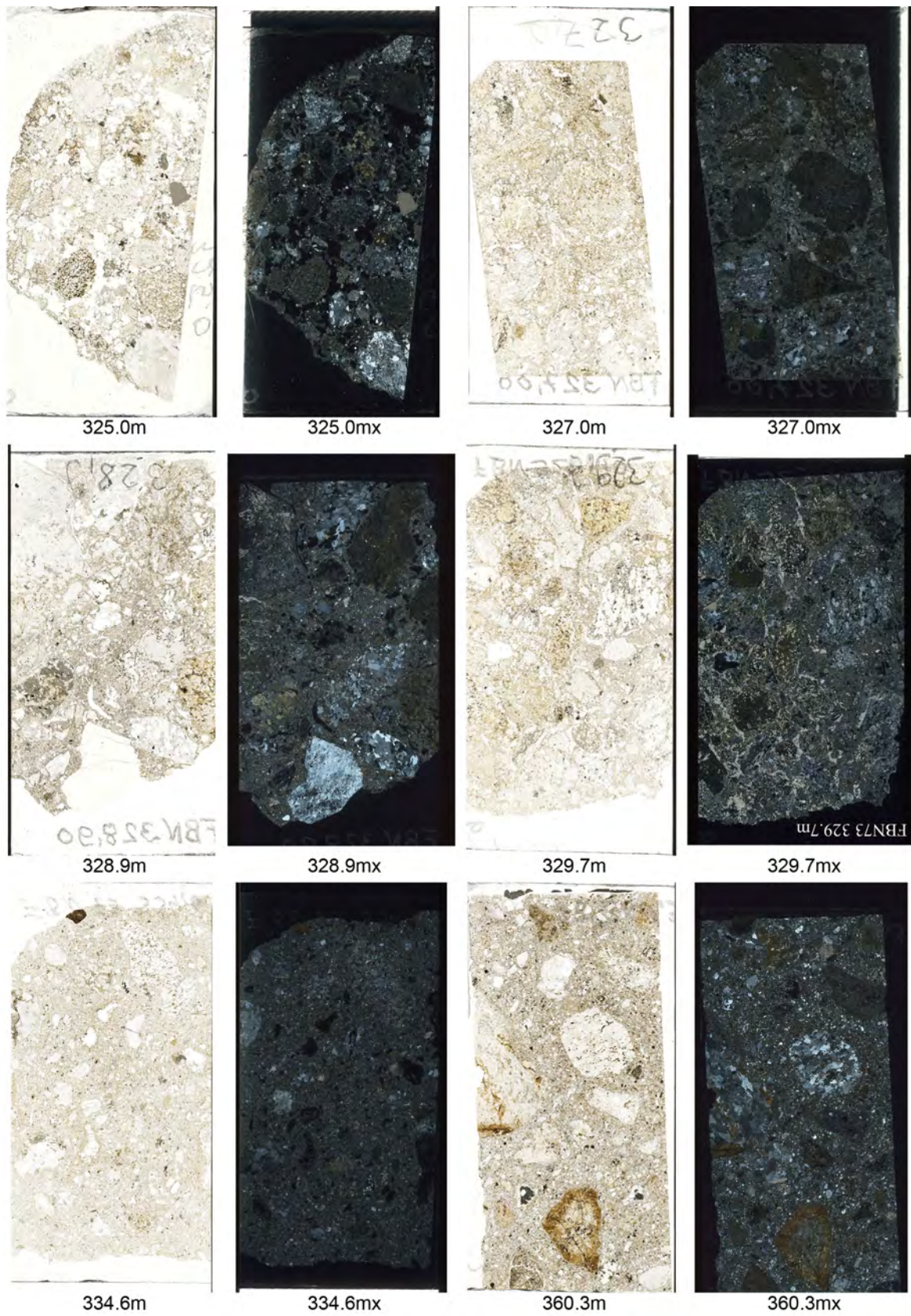


Fig. A.18.: Thin section photographs of FBN73 (325.0 - 360.3 m)

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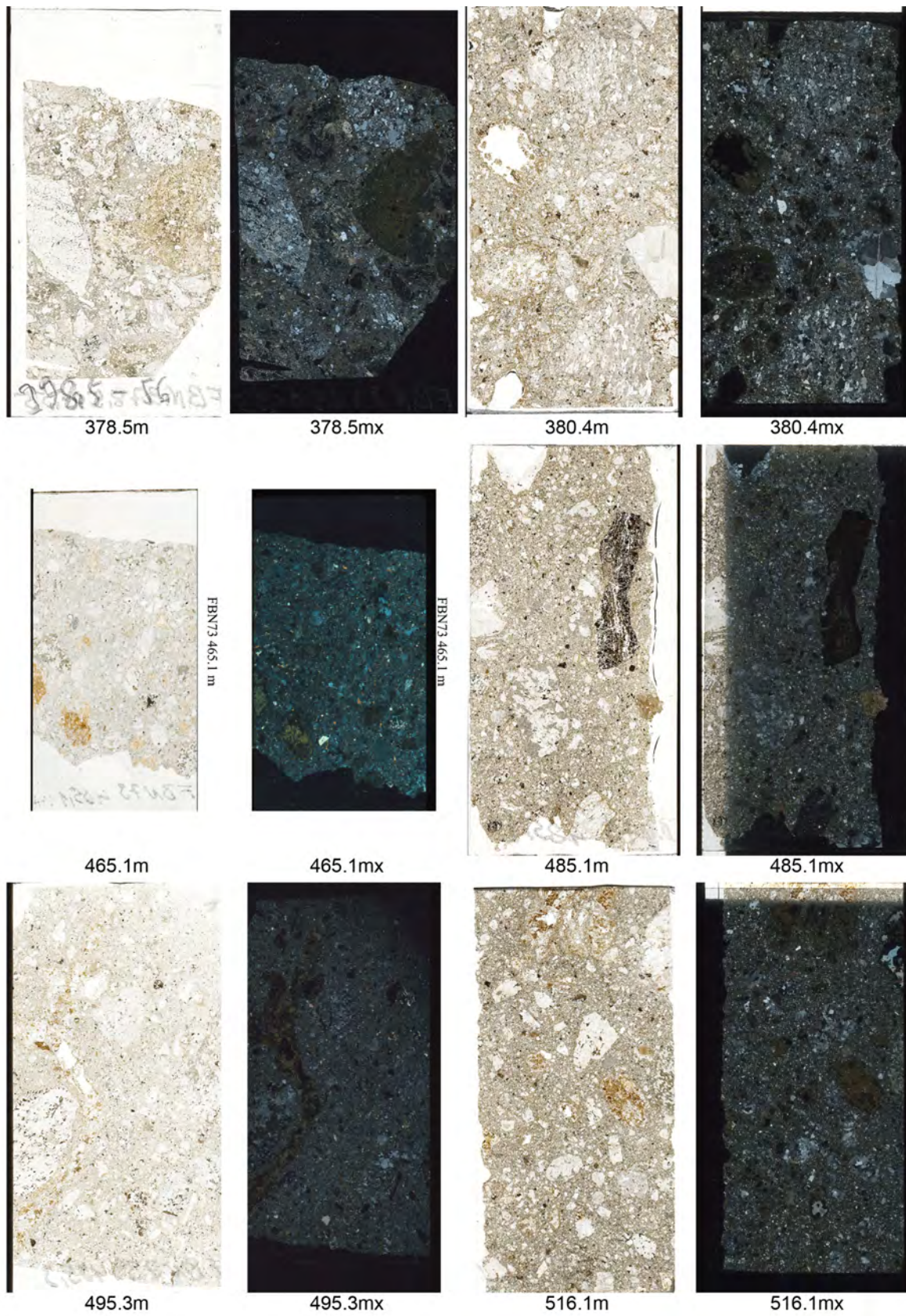


Fig. A.19.: Thin section photographs of FBN73 (378.5 - 516.1 m)

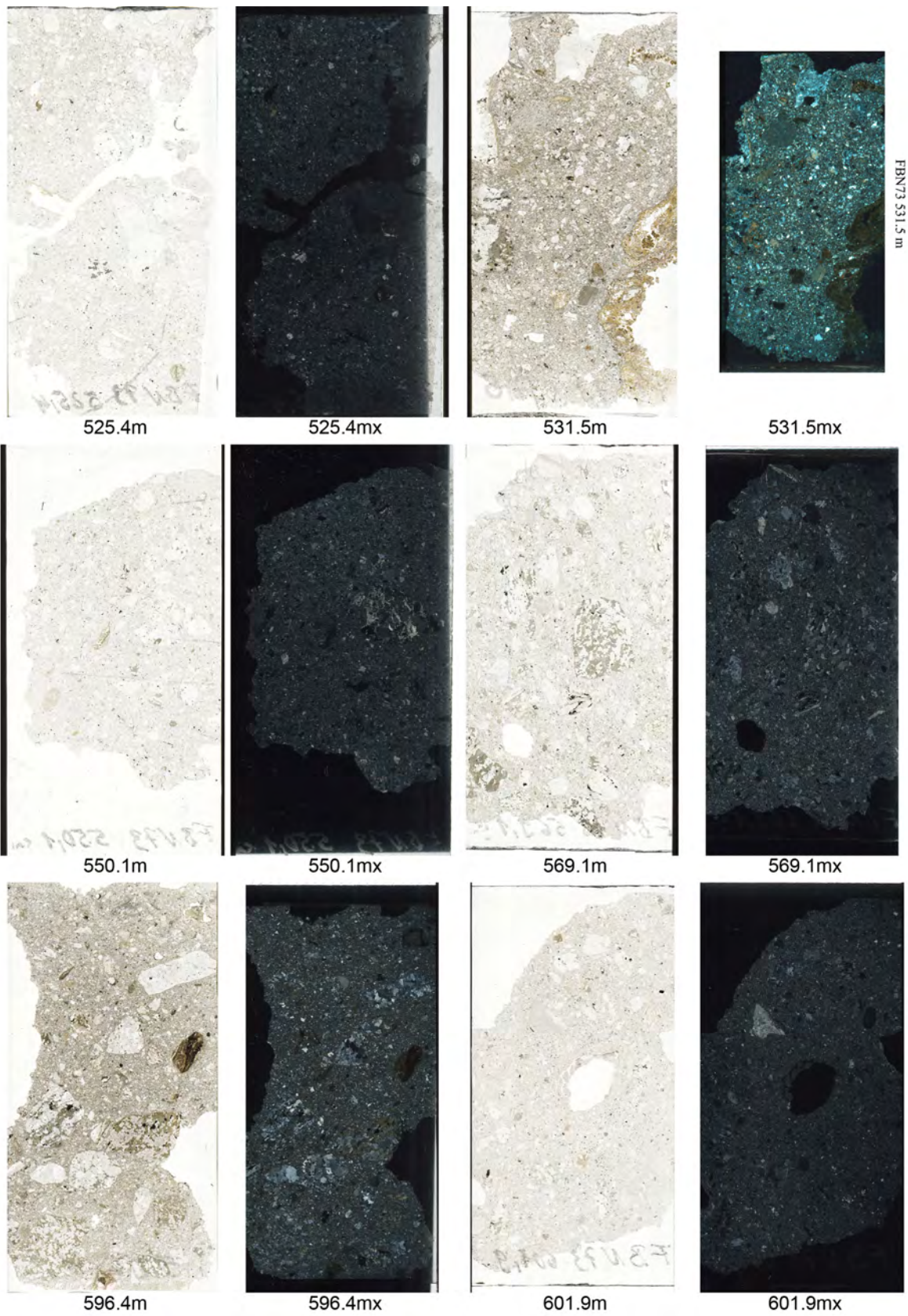


Fig. A.20.: Thin section photographs of FBN73 (525.4 - 601.9 m)

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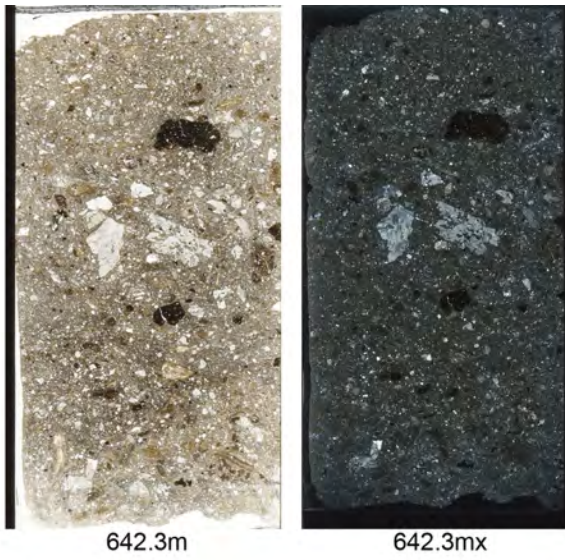


Fig. A.21.: Thin section photographs of FBN73 (642.3 m)

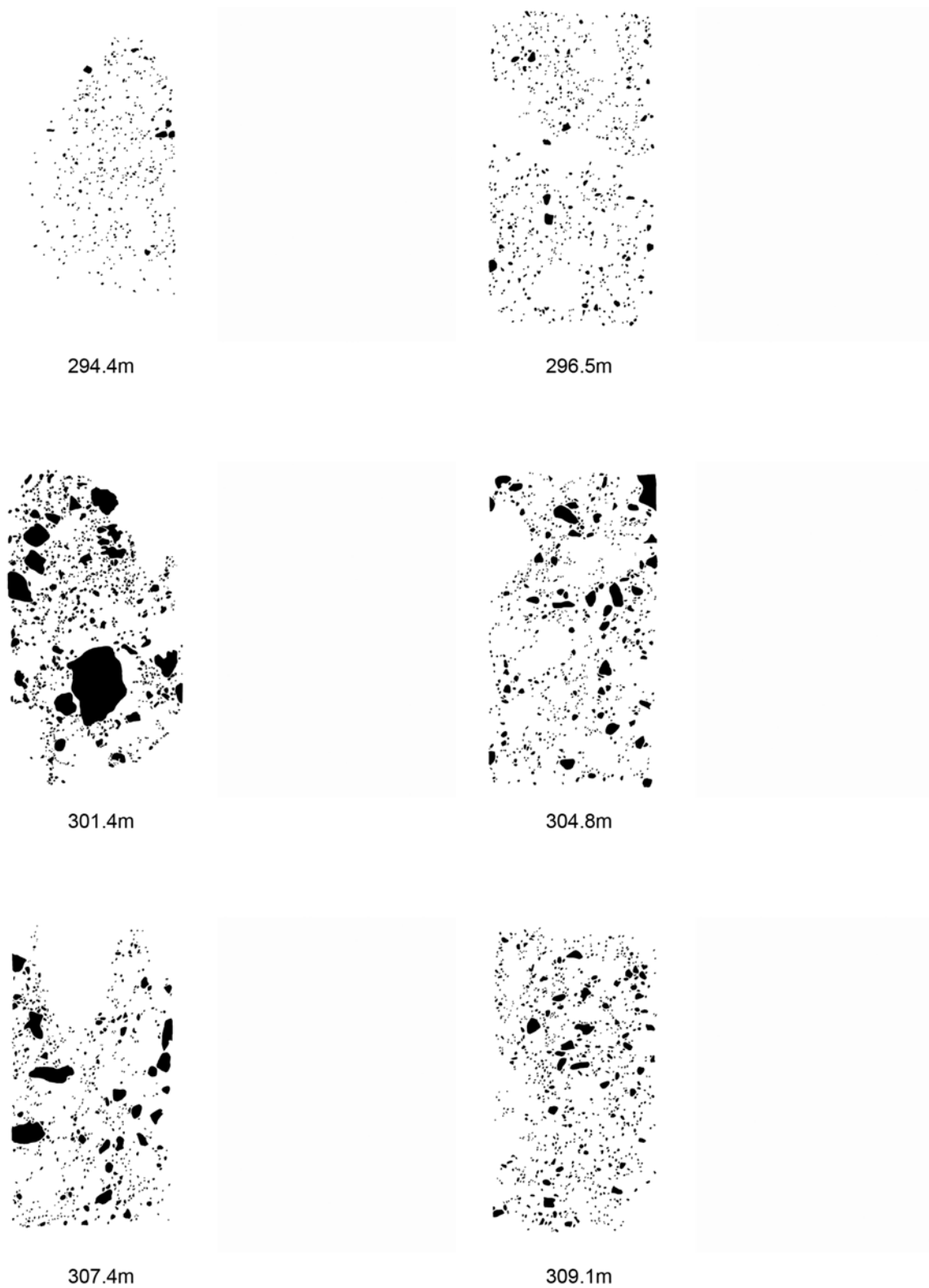
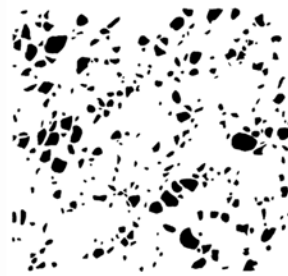


Fig. A.22.: Thin section templates of FBN73 (lithic clasts 294.4 - 309.1 m)

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318.0m



319.25m



320.0m



321.05m



321.25m



323.18m

Fig. A.23.: Thin section templates of FBN73 (lithic clasts 318.0 - 323.18 m)

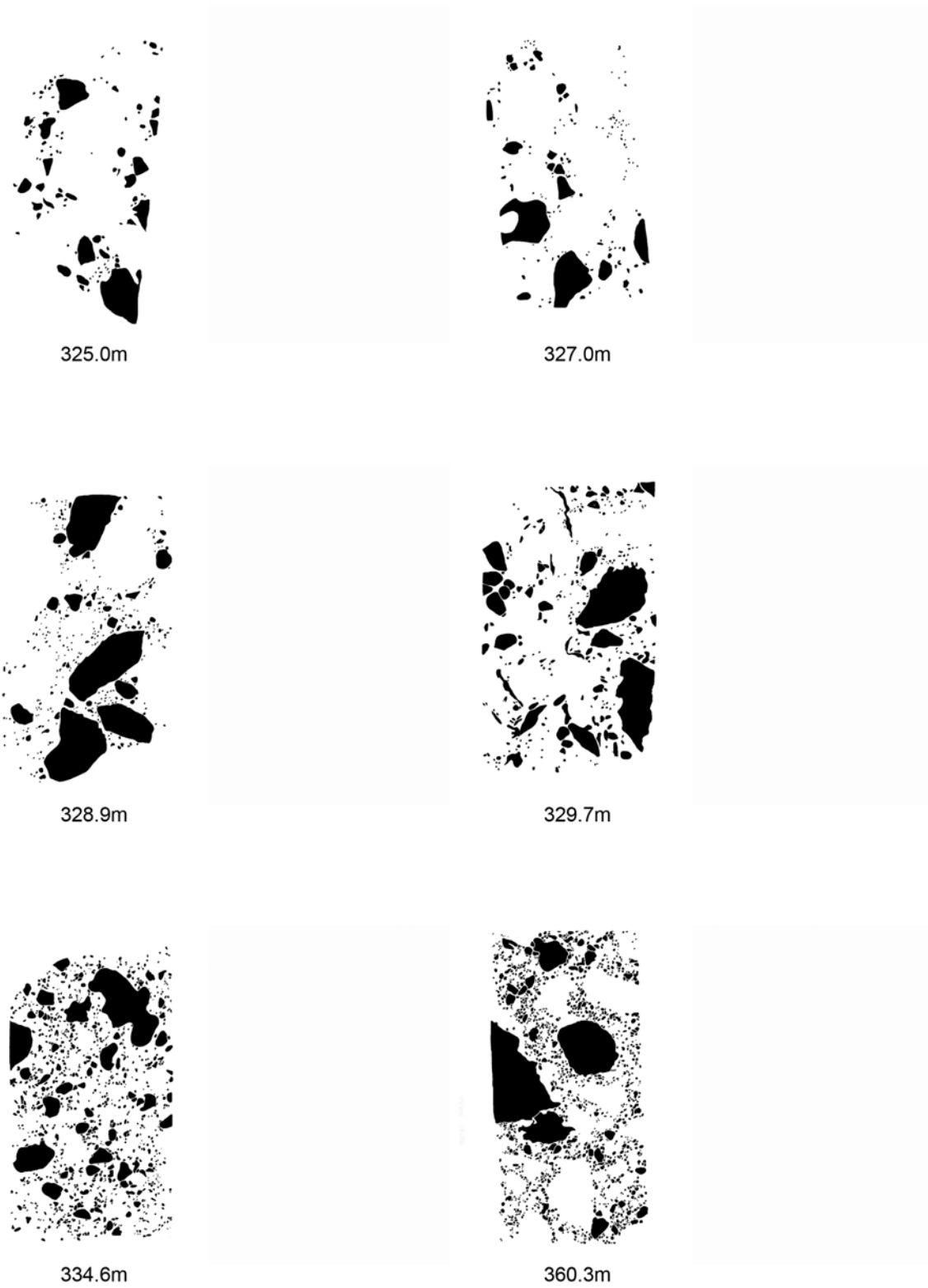
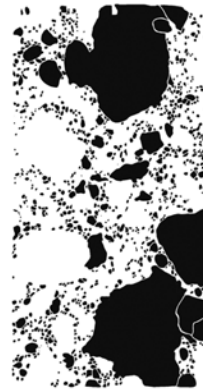


Fig. A.24.: Thin section templates of FBN73 (lithic clasts 325.0 - 360.3 m)

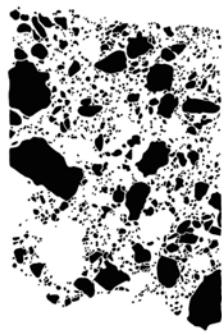
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378.5m



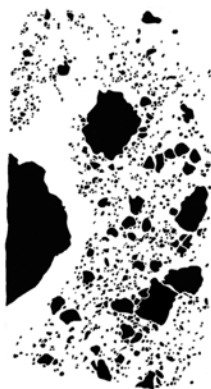
380.4m



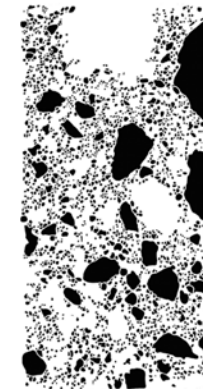
465.1m



485.1m



495.3m

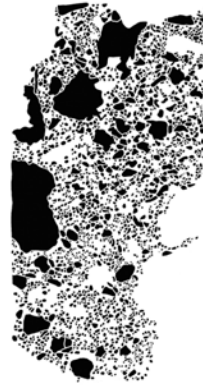


516.1m

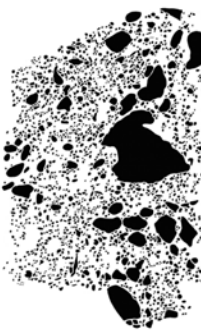
Fig. A.25.: Thin section templates of FBN73 (lithic clasts 378.5 - 516.1 m)



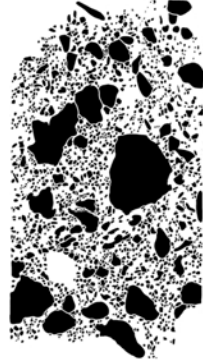
525.4m



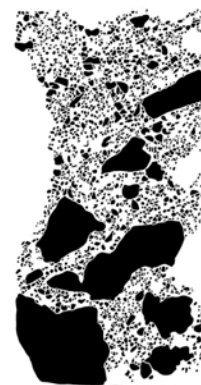
531.5m



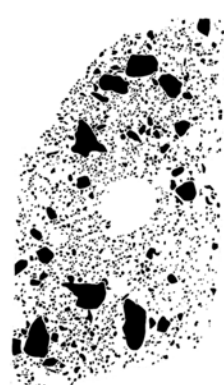
550.1m



569.1m



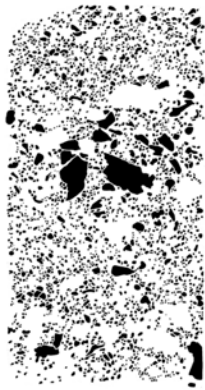
596.4m



601.9m

Fig. A.26.: Thin section templates of FBN73 (lithic clasts 525.4 - 601.9 m)

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642.3m

Fig. A.27.: Thin section templates of FBN73 (lithic clasts 642.3 m)

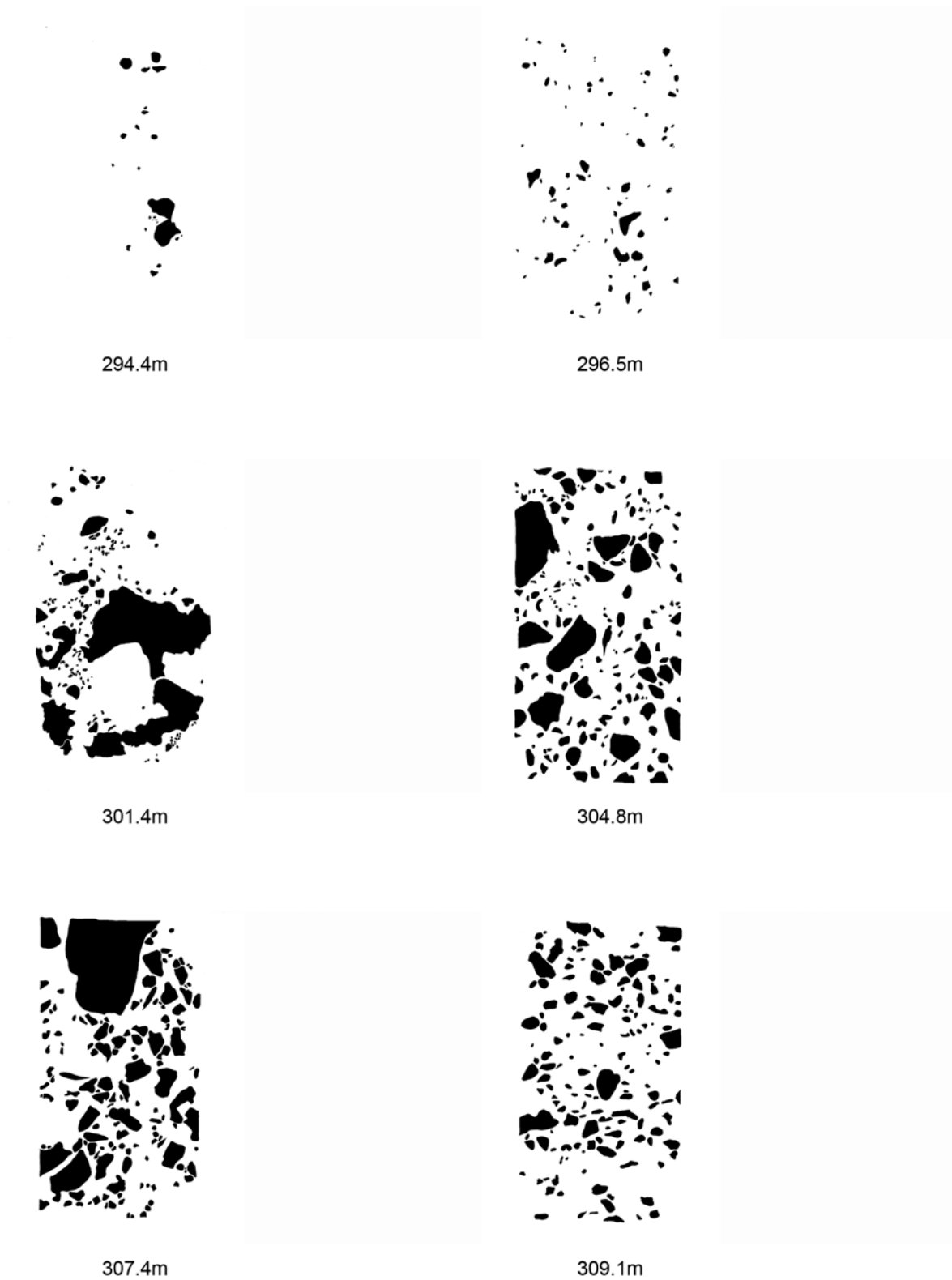


Fig. A.28.: Thin section templates of FBN73 (melt particles 294.4 - 309.1 m)

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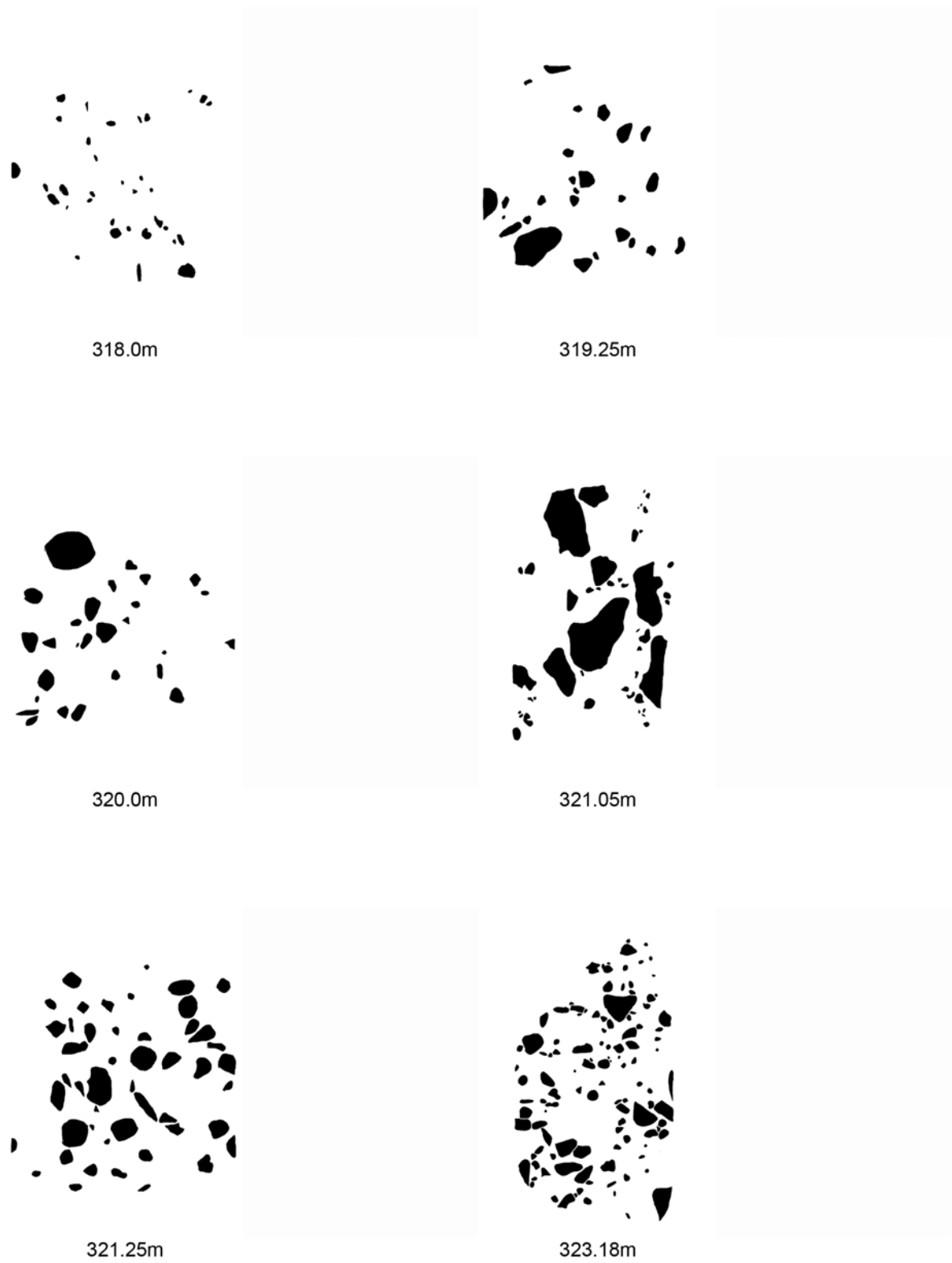


Fig. A.29.: Thin section templates of FBN73 (melt particles 318.0 - 323.18 m)



325.0m



327.0m



328.9m



329.7m



334.6m



360.3m

Fig. A.30.: Thin section templates of FBN73 (melt particles 325.0 - 360.3 m)

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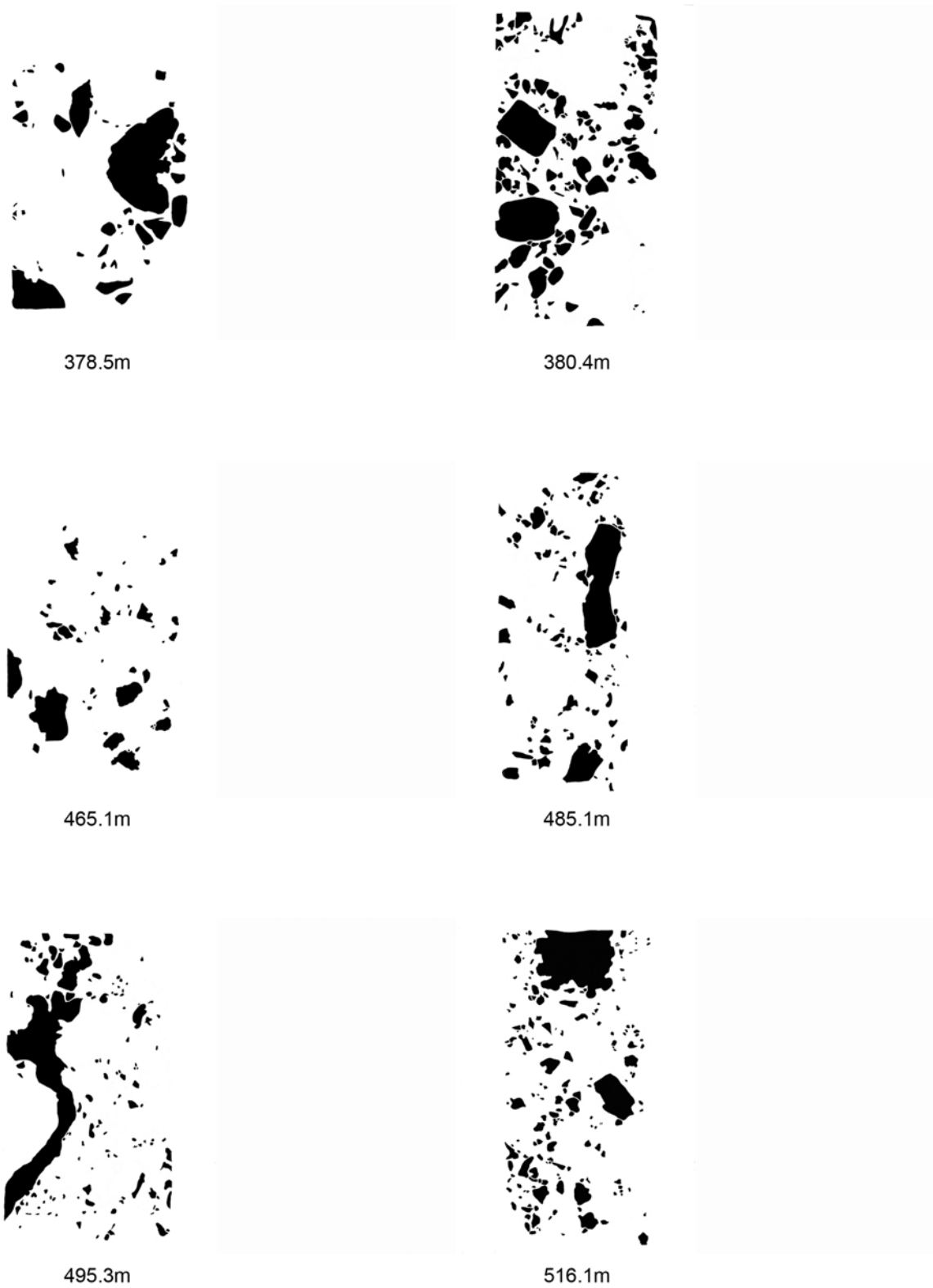


Fig. A.31.: Thin section templates of FBN73 (melt particles 378.5 - 516.1 m)

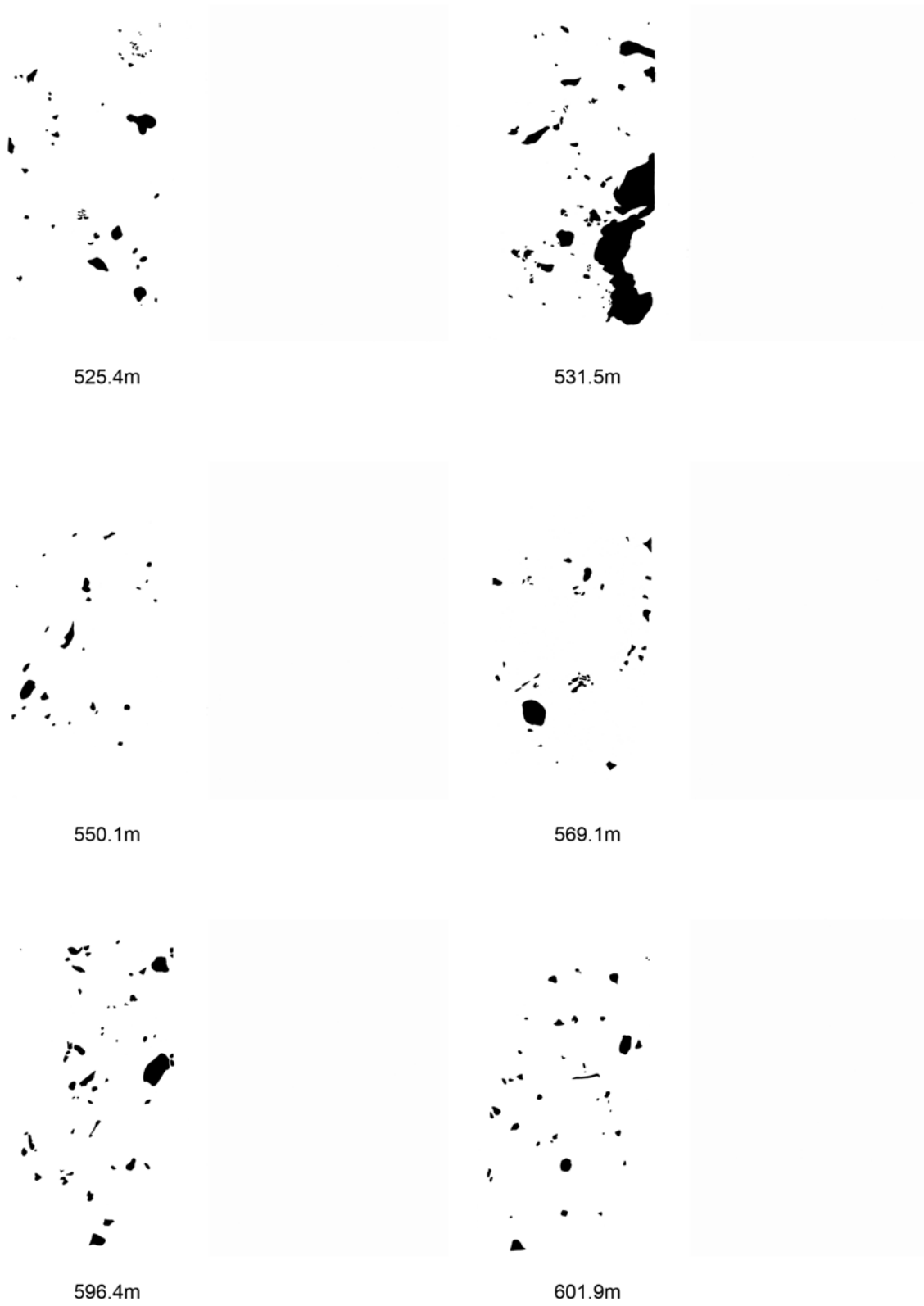


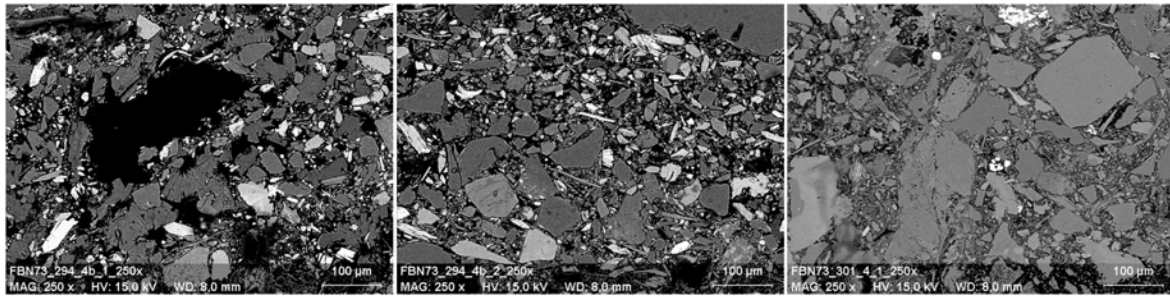
Fig. A.32.: Thin section templates of FBN73 (melt particles 525.4 - 601.9 m)

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642.3m

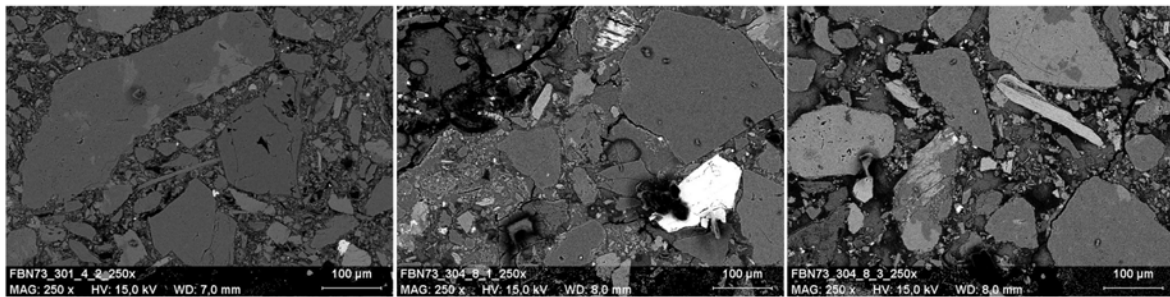
Fig. A.33.: Thin section templates of FBN73 (melt particles 642.3 m)



294.4m

294.4m

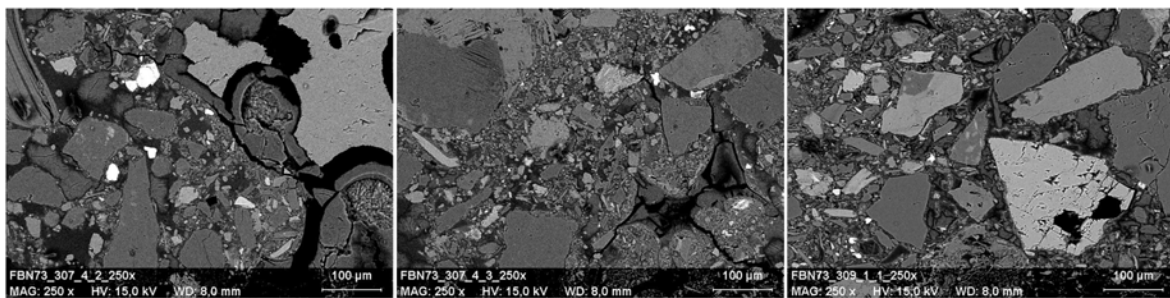
301.4m



301.4m

304.8m

304.8m



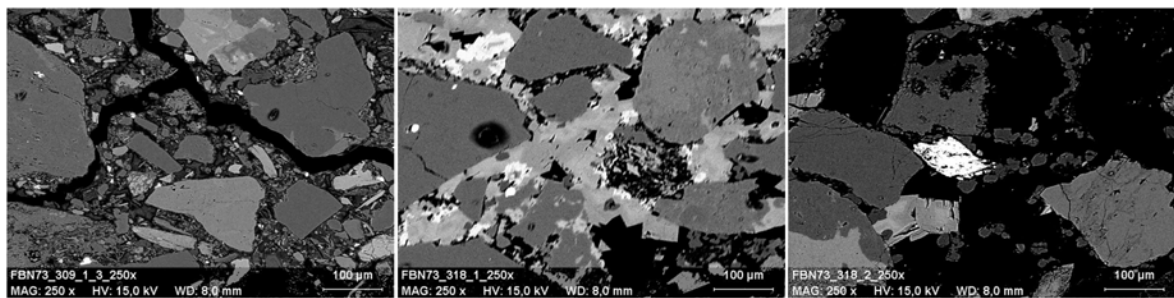
307.4m

307.4m

309.1m

Fig. A.34.: SE pictures of FBN73 (294.4 - 309.1 m)

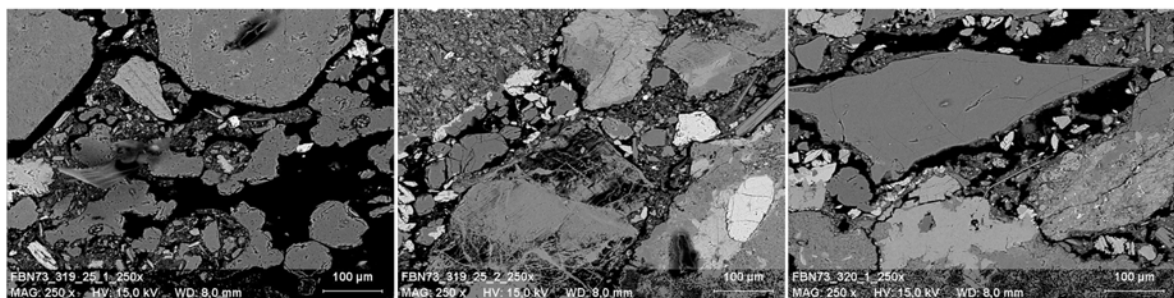
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309.1m

318m

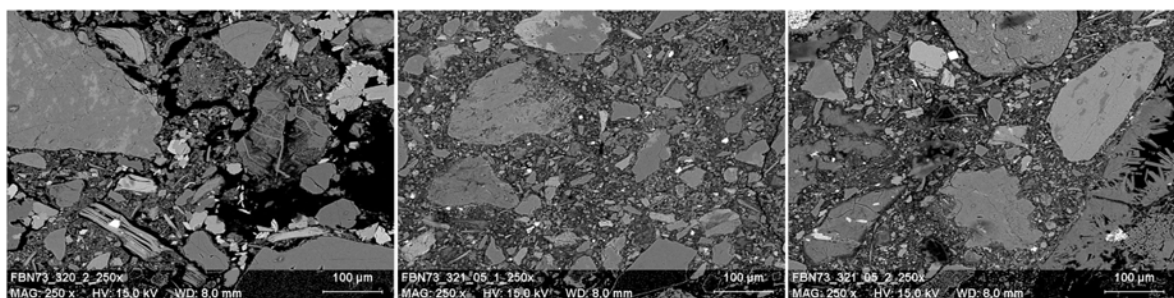
318m



319.25m

319.25m

320m

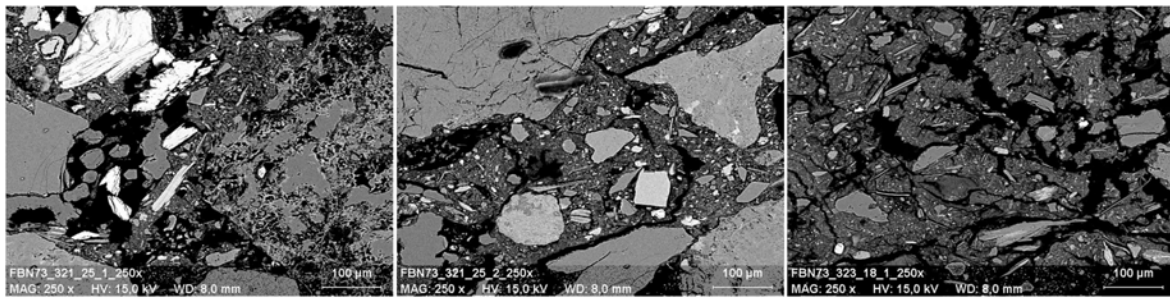


320m

321.05m

321.05m

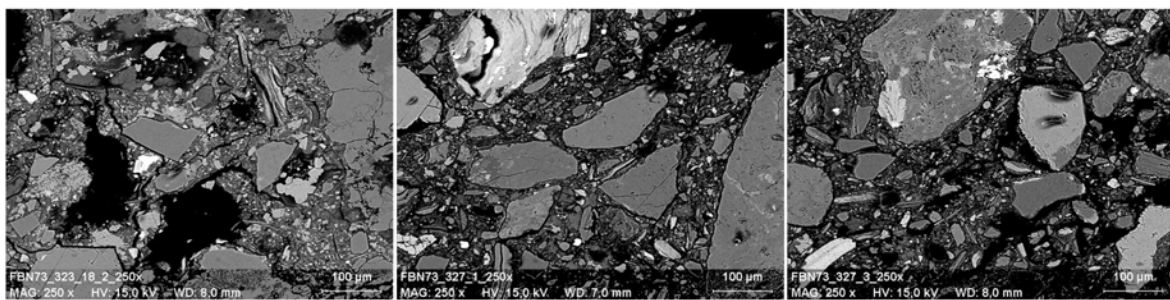
Fig. A.35.: SE pictures of FBN73 (309.1 - 321.05 m)



321.25m

321.25m

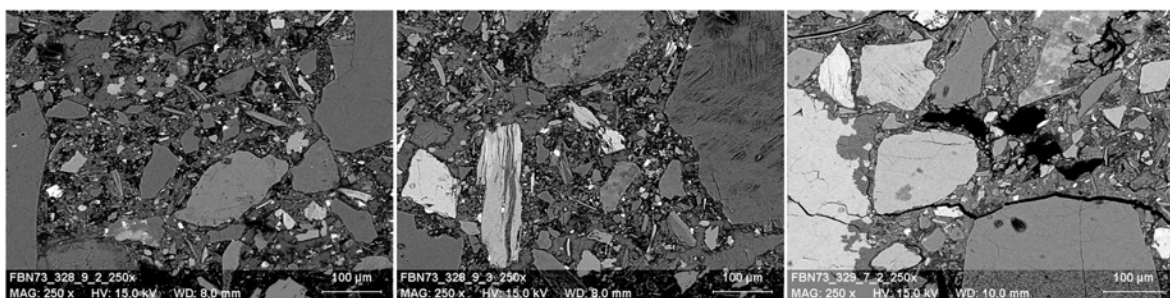
323.18m



323.18m

327m

327m



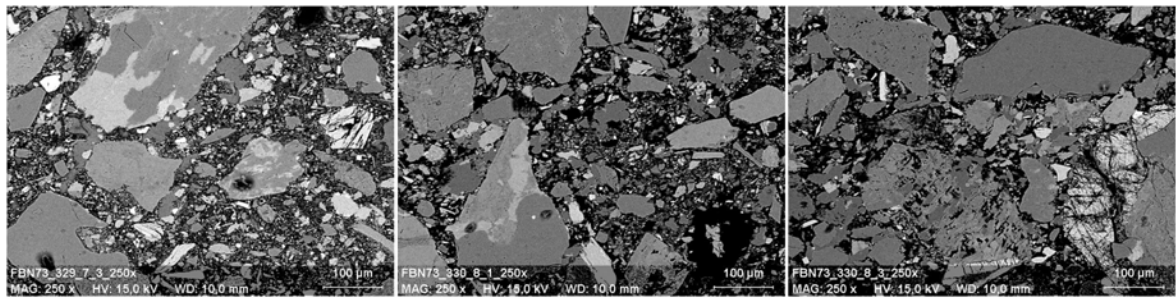
328.9m

328.9m

329.7m

Fig. A.36.: SE pictures of FBN73 (321.25 - 329.7 m)

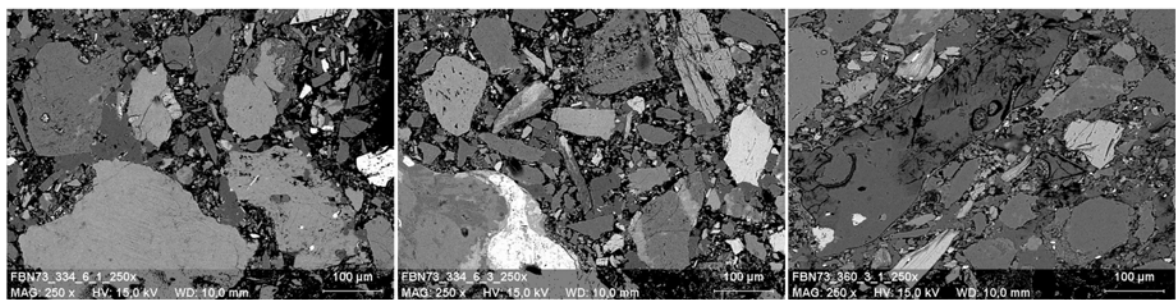
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329.7m

330.8m

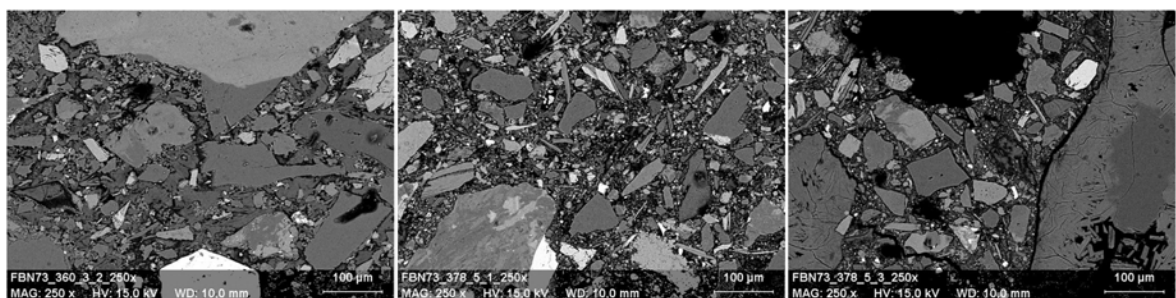
330.8m



334.6m

334.6m

360.3m

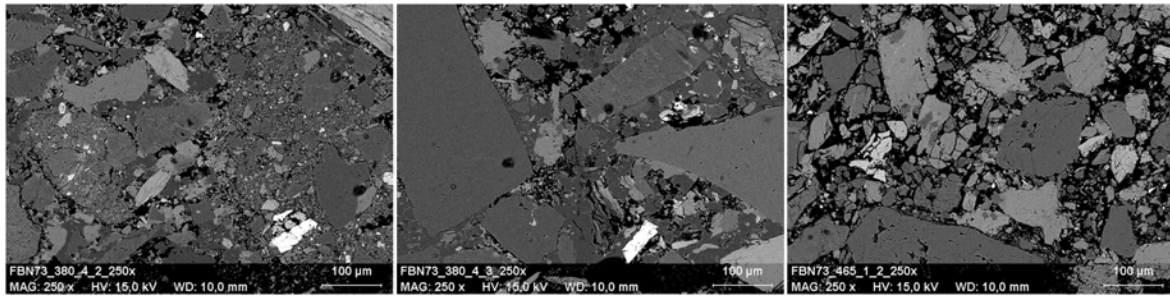


360.3m

378.5m

378.5m

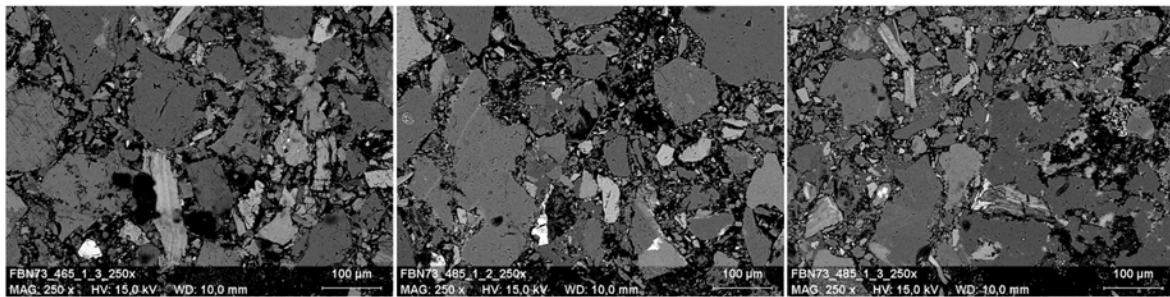
Fig. A.37.: SE pictures of FBN73 (329.7 - 378.5 m)



380.4m

380.4m

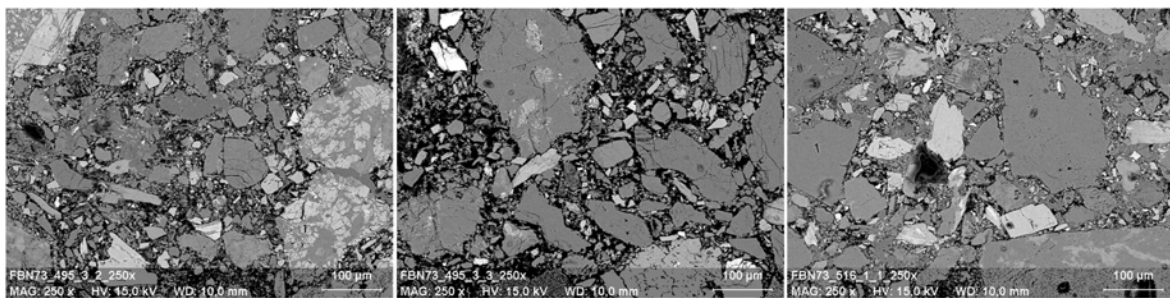
465.1m



465.1m

485.1m

485.1m



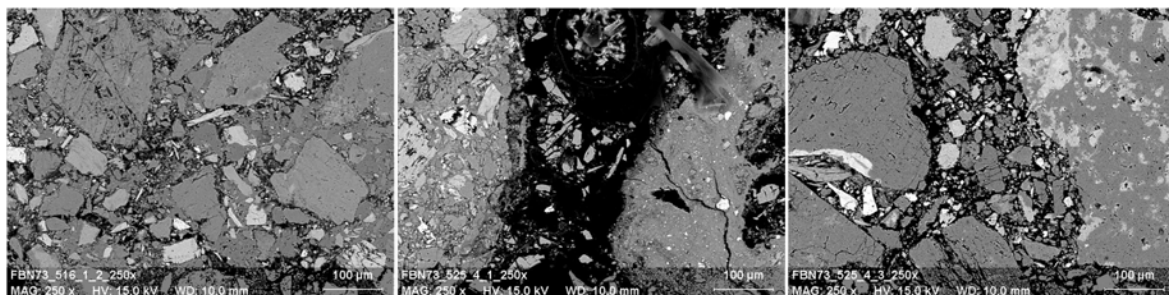
495.3m

495.3m

516.1m

Fig. A.38.: SE pictures of FBN73 (380.4 - 516.1 m)

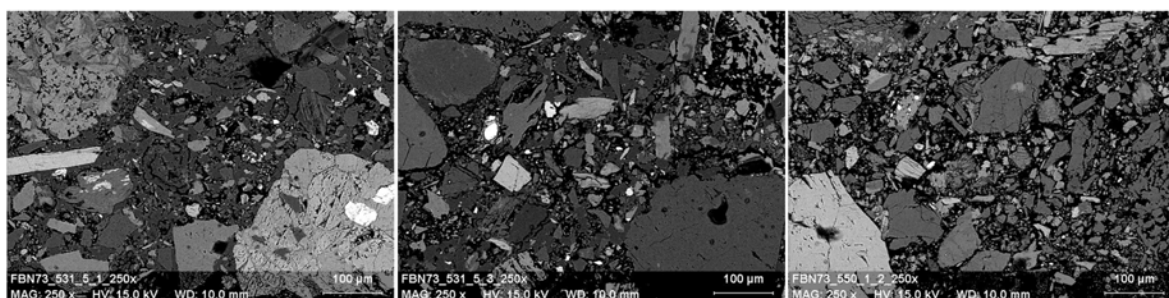
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516.1m

525.4m

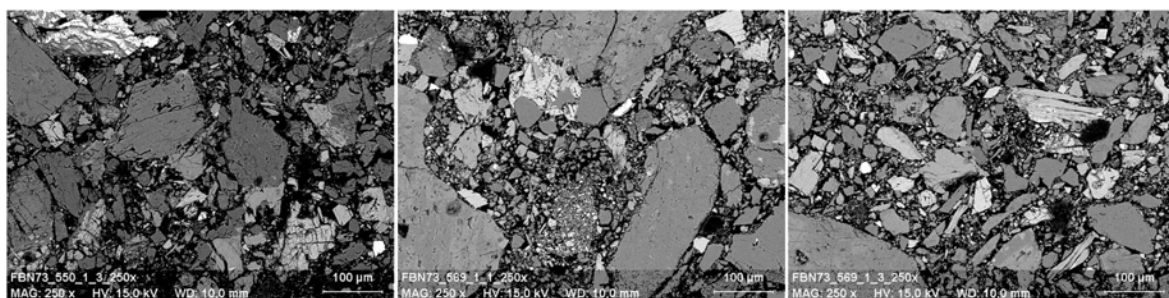
525.4m



531.5m

531.5m

550.1m

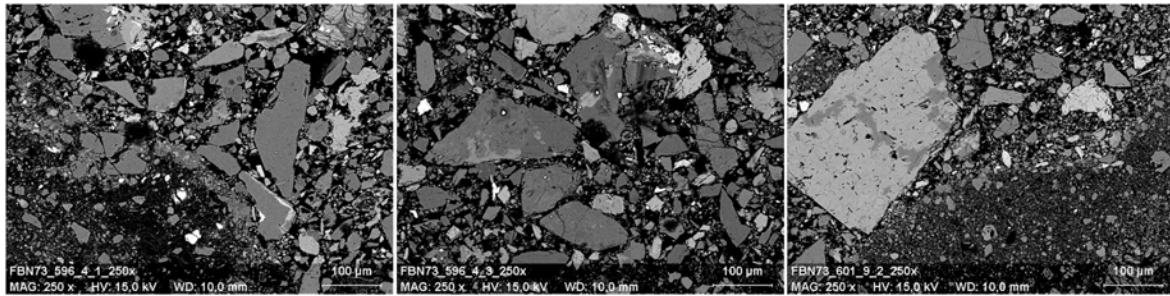


550.1m

569.1m

569.1m

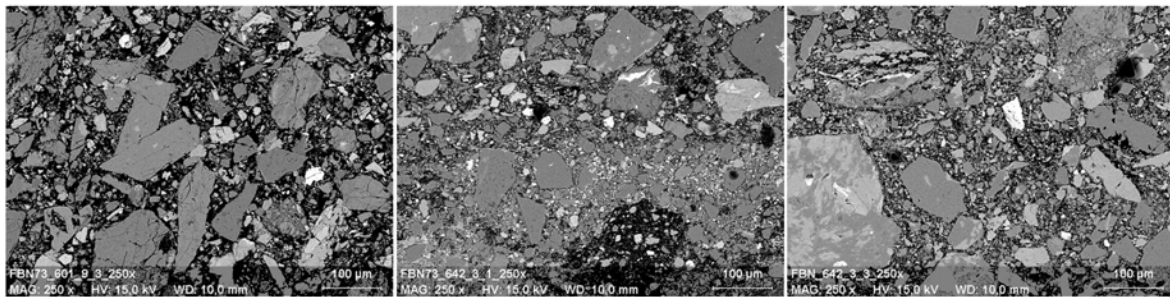
Fig. A.39.: SE pictures of FBN73 (516.1 - 569.1 m)



596.4m

596.4m

601.9m



601.9m

642.3m

642.3m

Fig. A.40.: SE pictures of FBN73 (596.4 - 642.3 m)

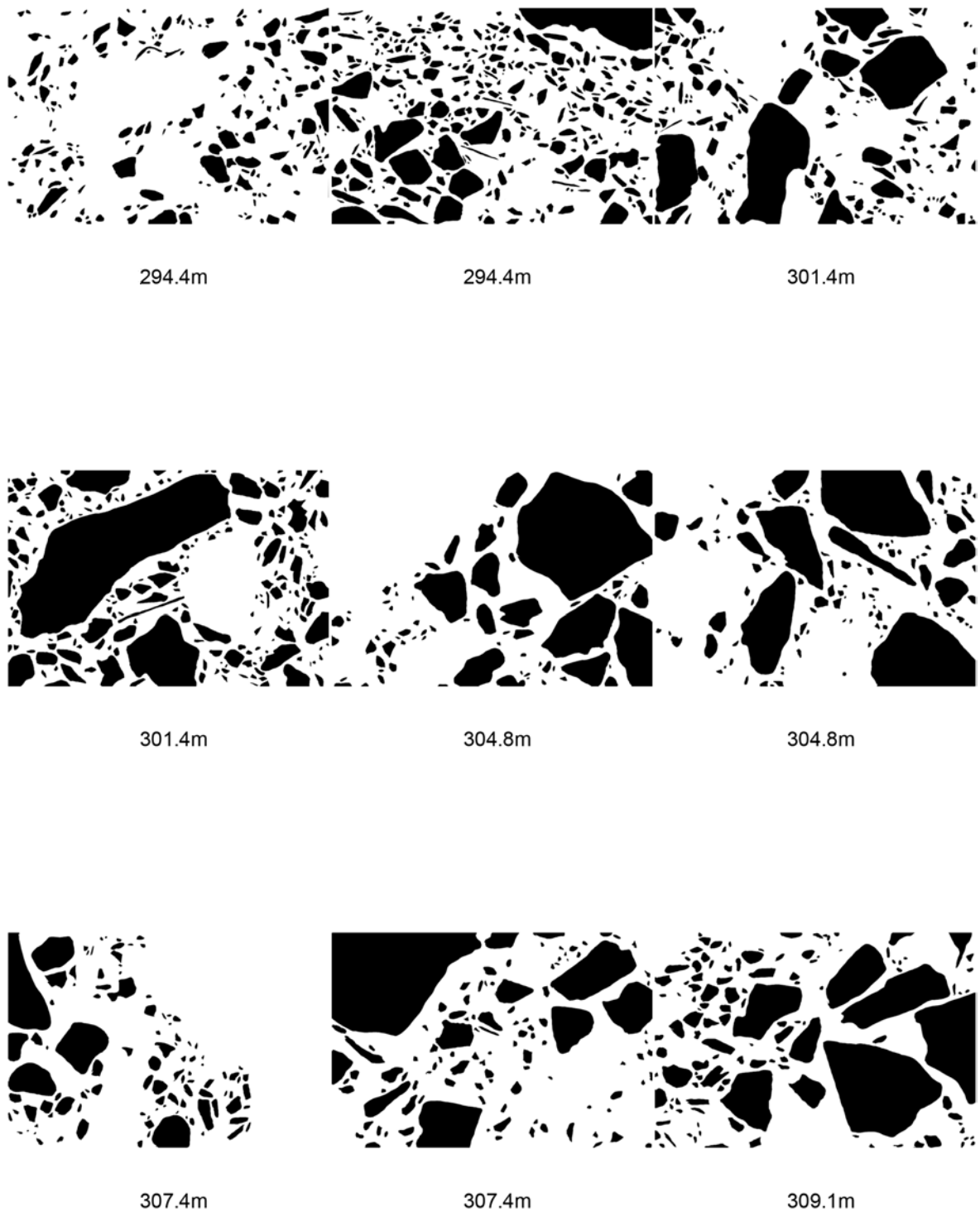
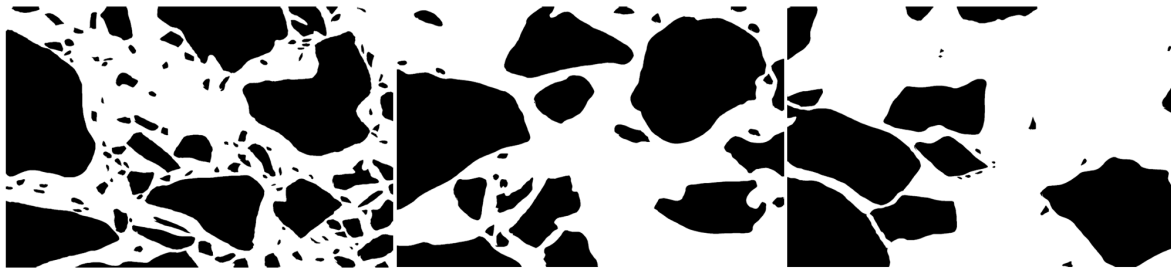


Fig. A.41.: SE templates of FBN73 (lithic clasts 294.4 - 309.1 m)



309.1m

318m

318m



319.25m

319.25m

320m



320m

321.05m

321.05m

Fig. A.42.: SE templates of FBN73 (lithic clasts 309.1 - 321.05 m)

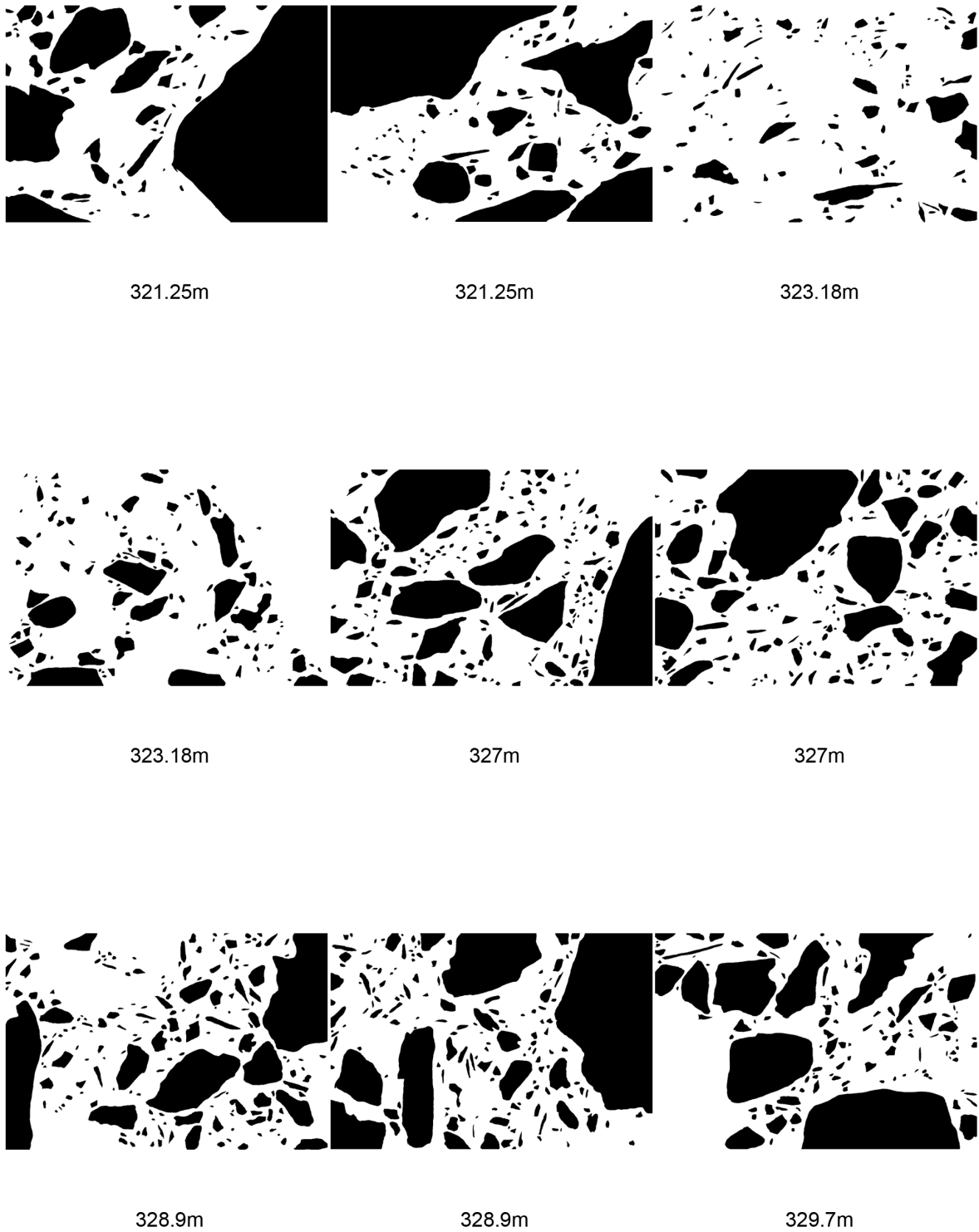
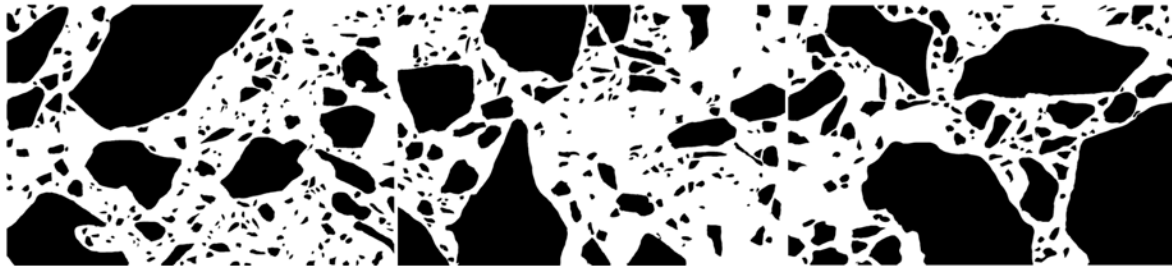


Fig. A.43.: SE templates of FBN73 (lithic clasts 321.25 - 329.7 m)



329.7m

330.8m

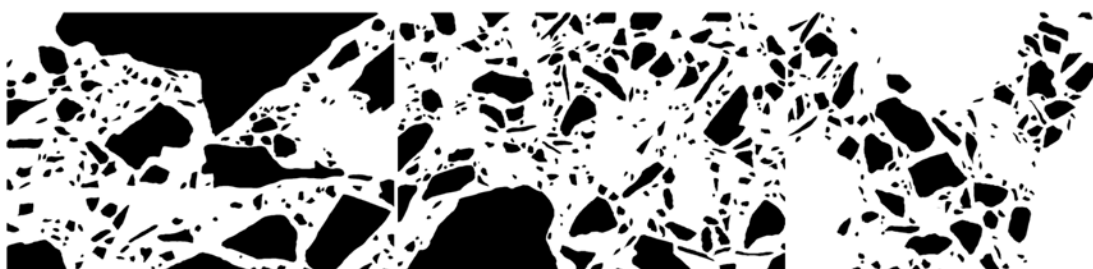
330.8m



334.6m

334.6m

360.3m

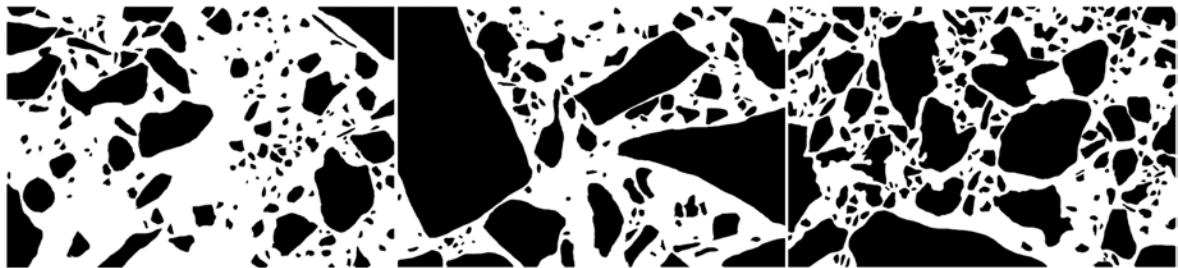


360.3m

378.5m

378.5m

Fig. A.44.: SE templates of FBN73 (lithic clasts 329.7 - 378.5 m)



380.4m

380.4m

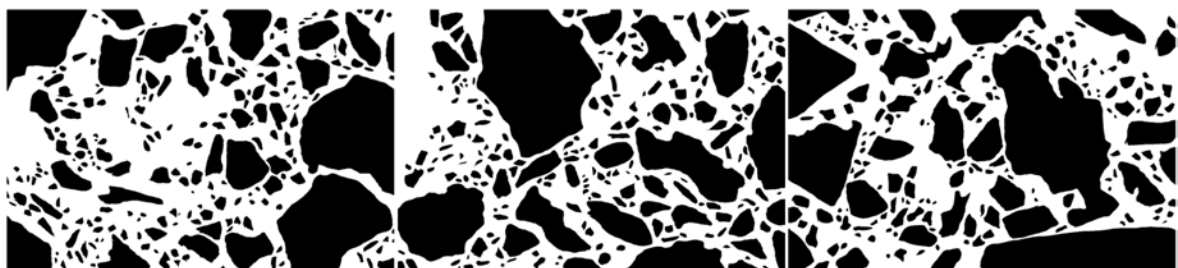
465.1m



465.1m

485.1m

485.1m



495.3m

495.3m

516.1m

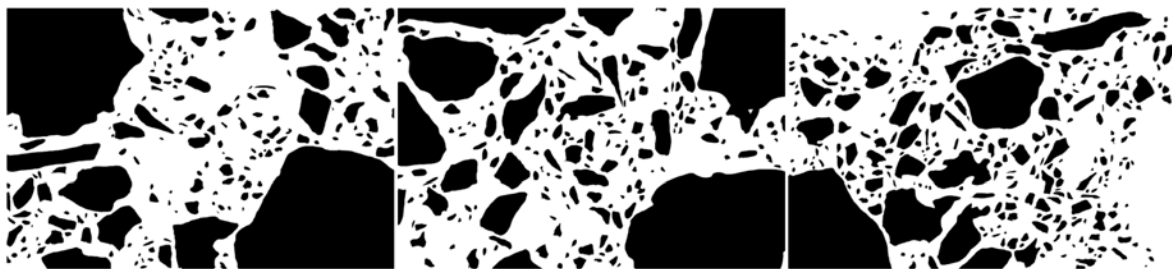
Fig. A.45.: SE templates of FBN73 (lithic clasts 380.4 - 516.1 m)



516.1m

525.4m

525.4m



531.5m

531.5m

550.1m



550.1m

569.1m

569.1m

Fig. A.46.: SE templates of FBN73 (lithic clasts 516.1 - 569.1 m)

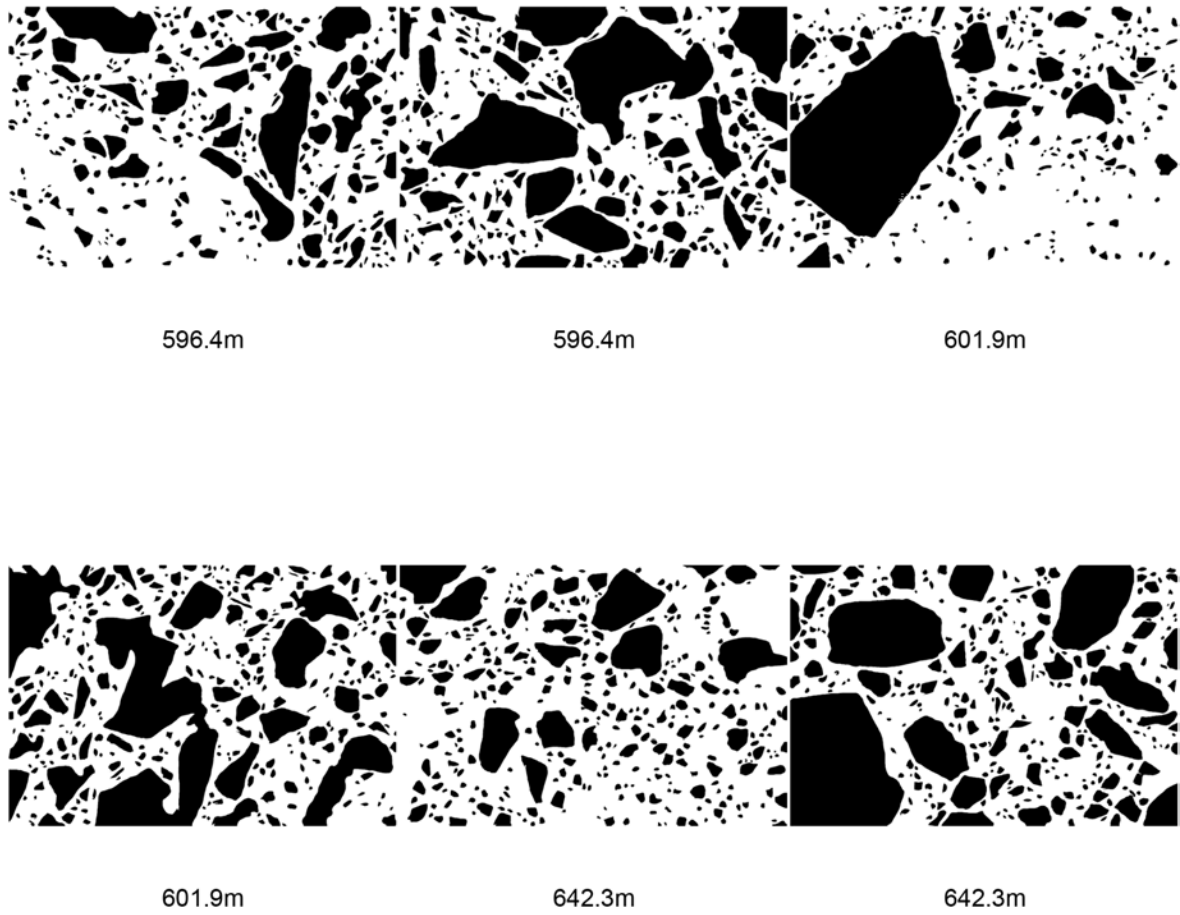


Fig. A.47.: SE templates of FBN73 (lithic clasts 596.4 - 642.3 m)



Fig. A.48.: SE templates of FBN73 (melt particles 294.4 - 309.1 m)

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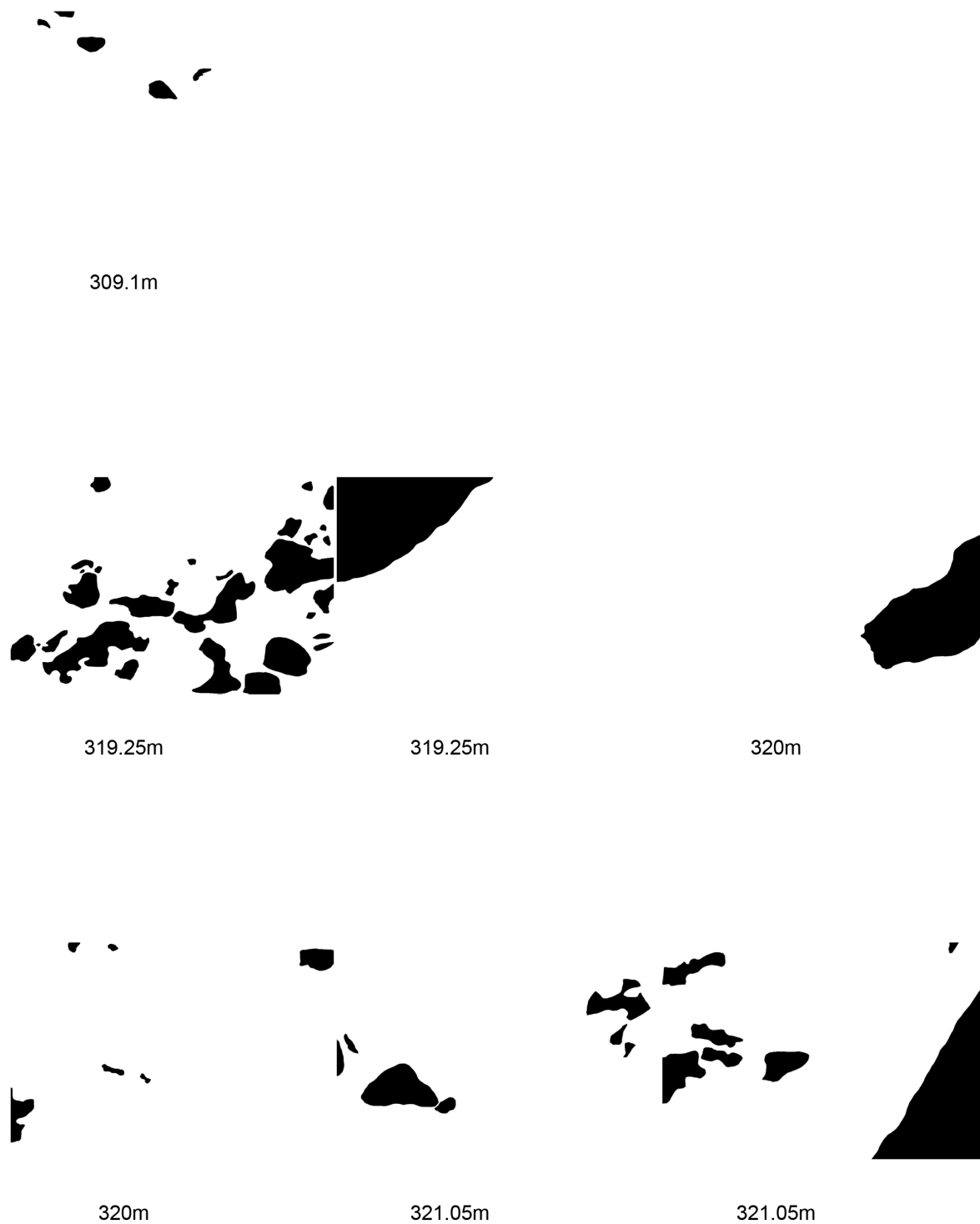


Fig. A.49.: SE templates of FBN73 (melt particles 309.1 - 321.05 m)

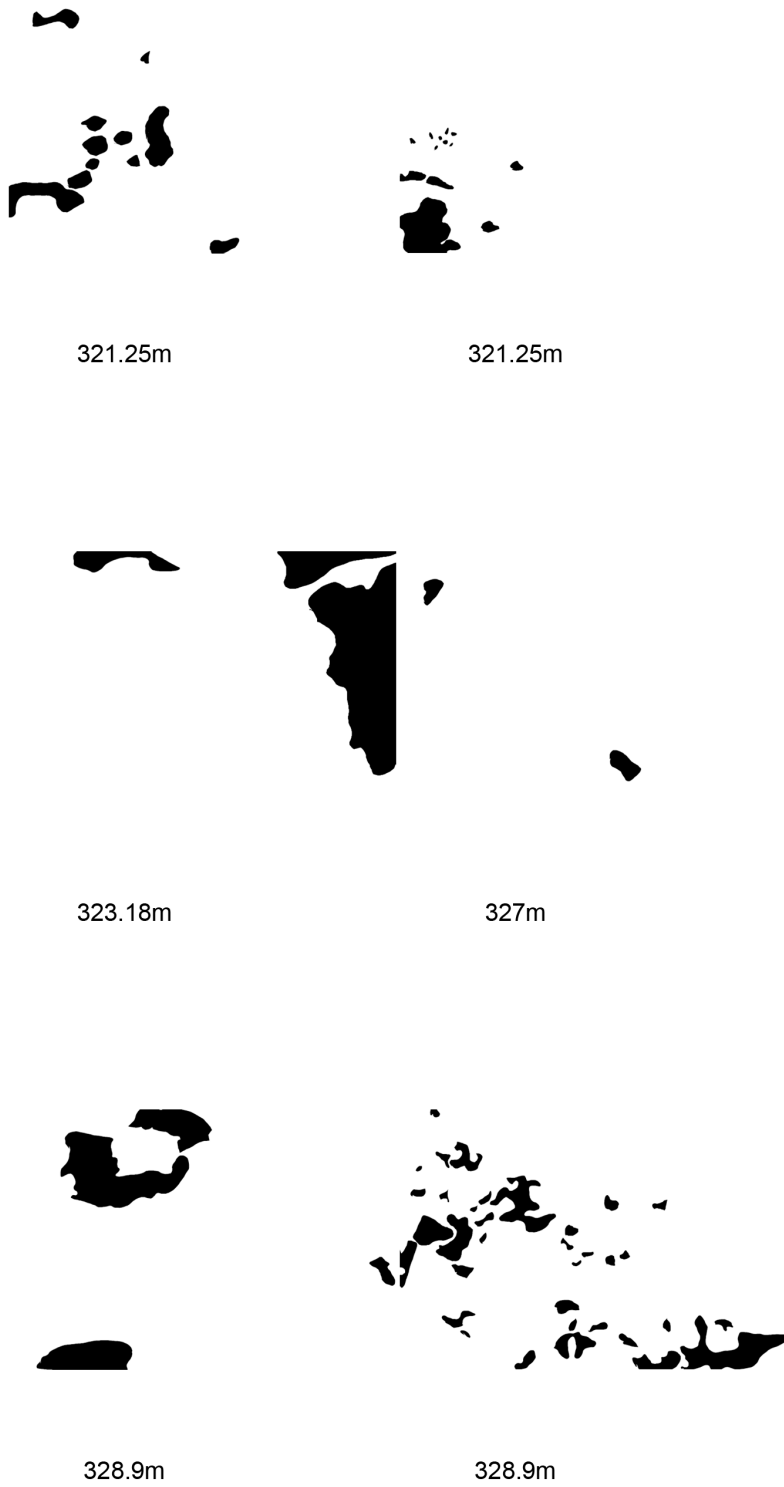


Fig. A.50.: SE templates of FBN73 (melt particles 321.25 - 328.9 m)

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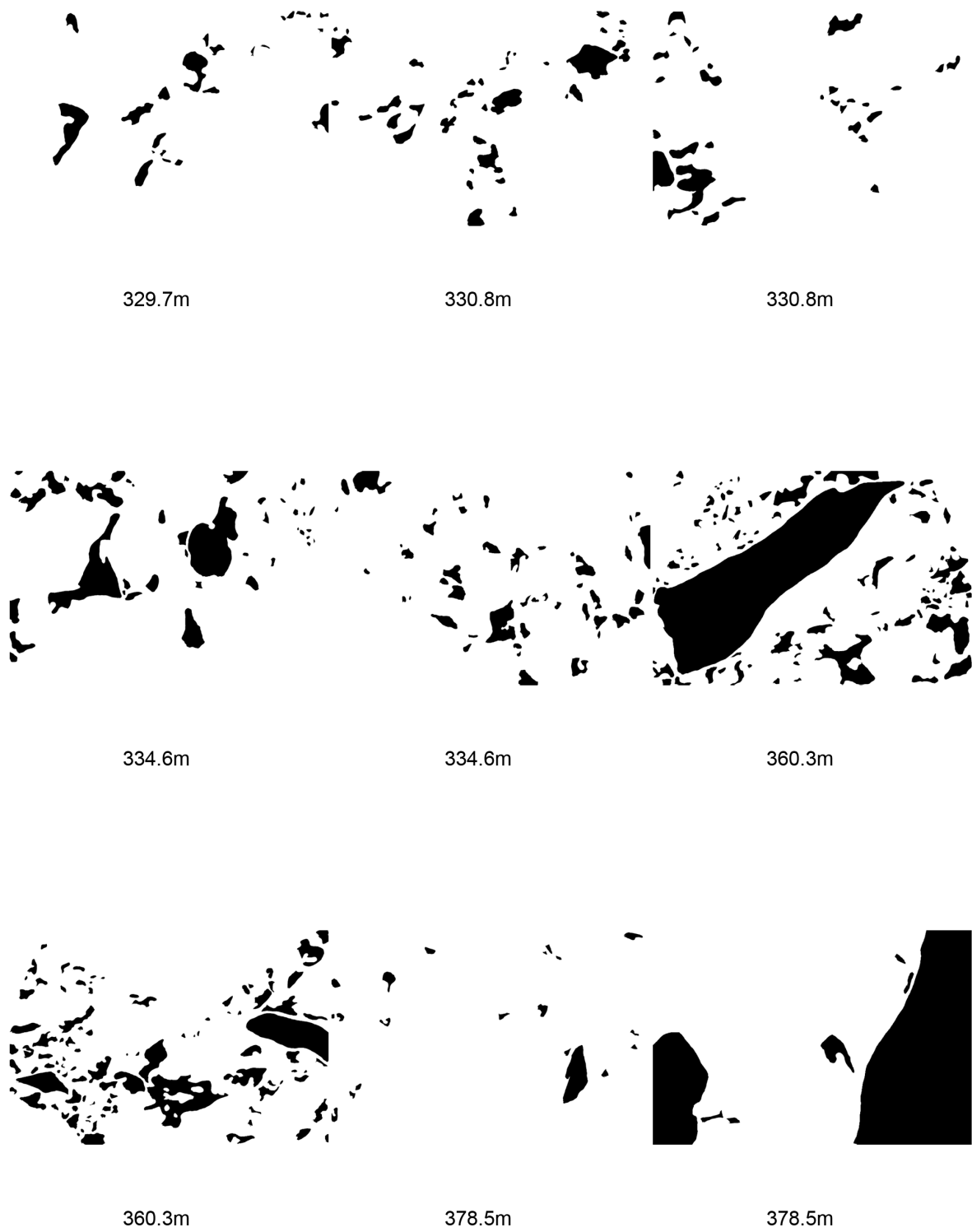


Fig. A.51.: SE templates of FBN73 (melt particles 329.7 - 378.5 m)

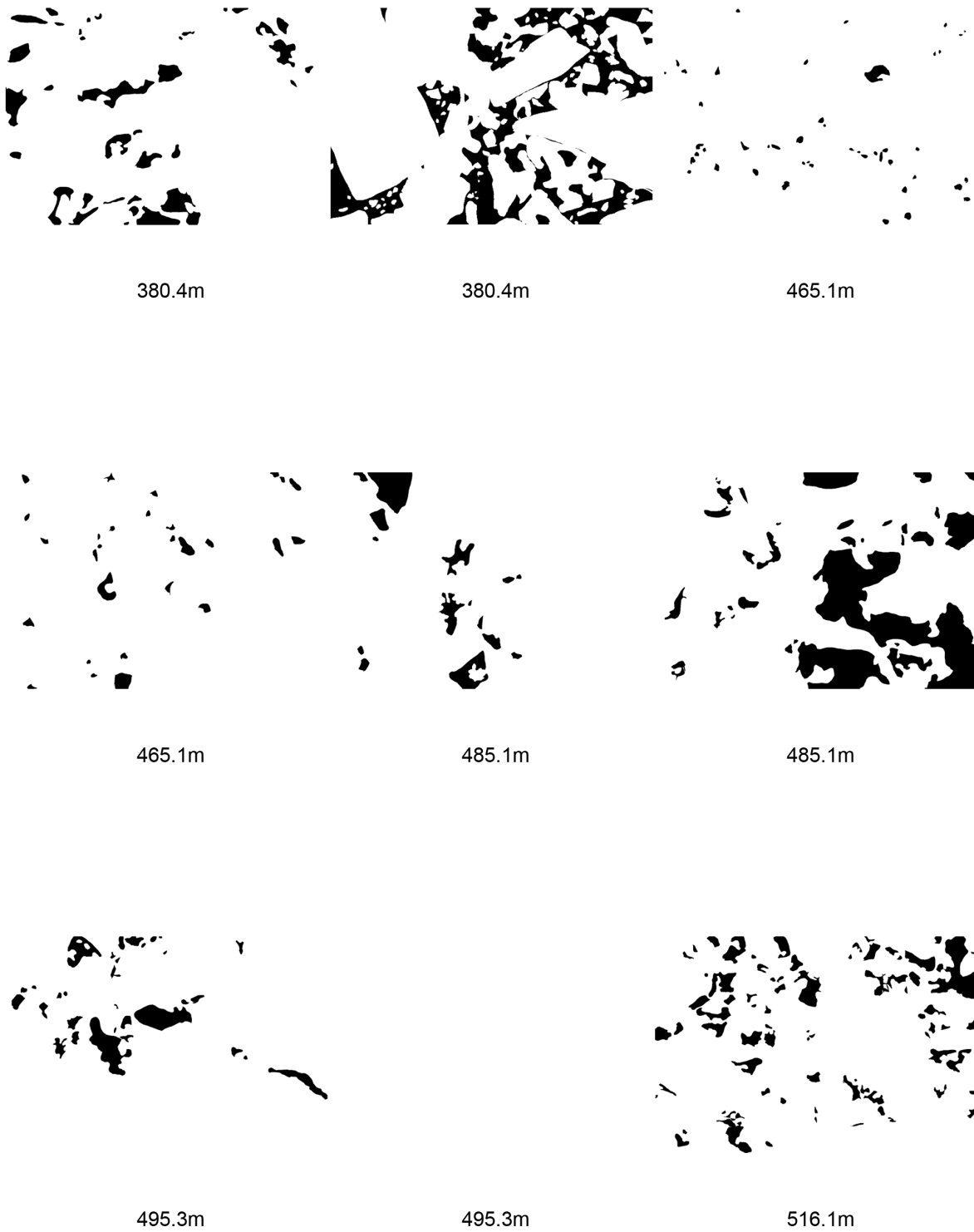


Fig. A.52.: SE templates of FBN73 (melt particles 380.4 - 516.1 m)

A. Appendix 1

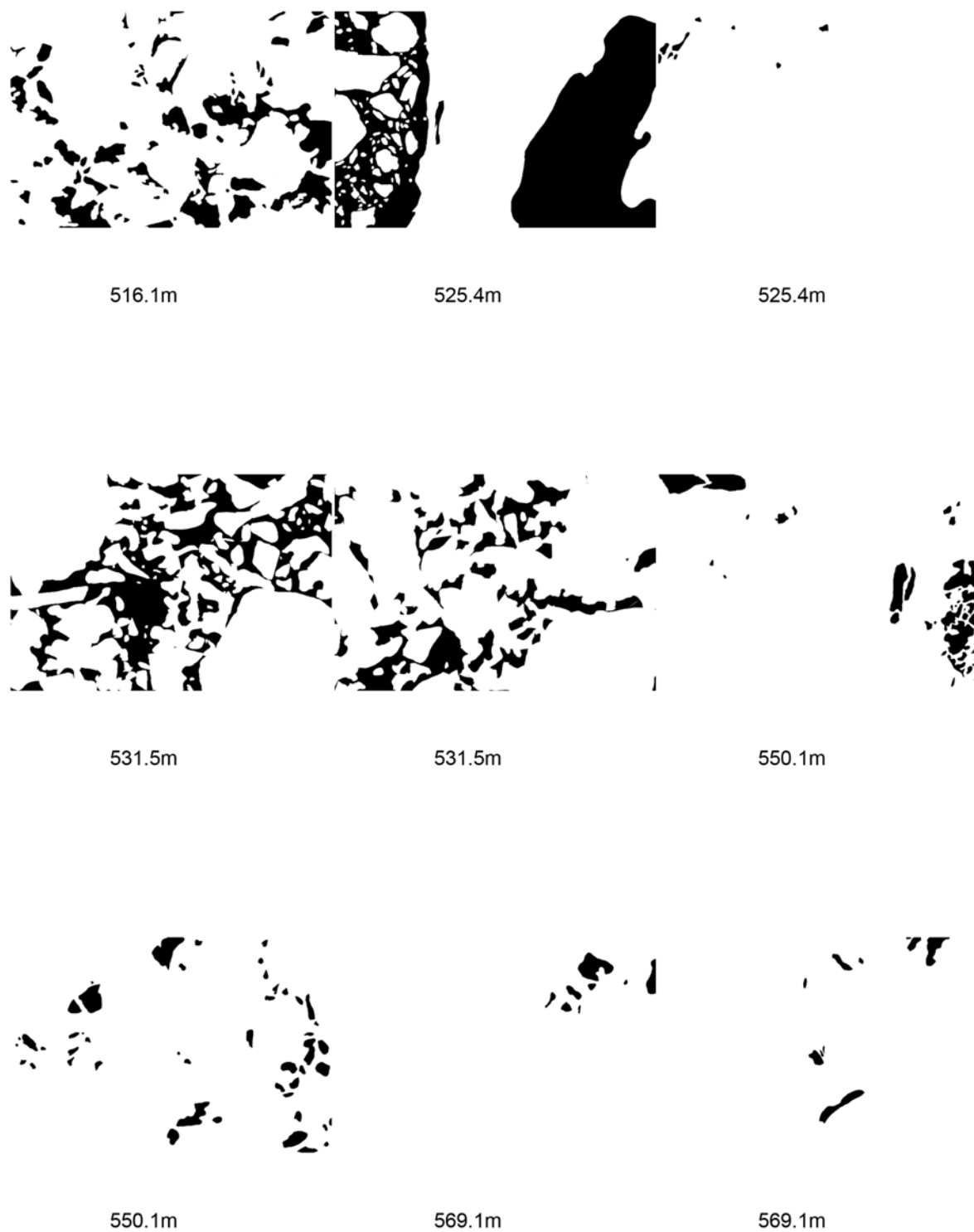


Fig. A.53.: SE templates of FBN73 (melt particles 516.1 - 569.1 m)

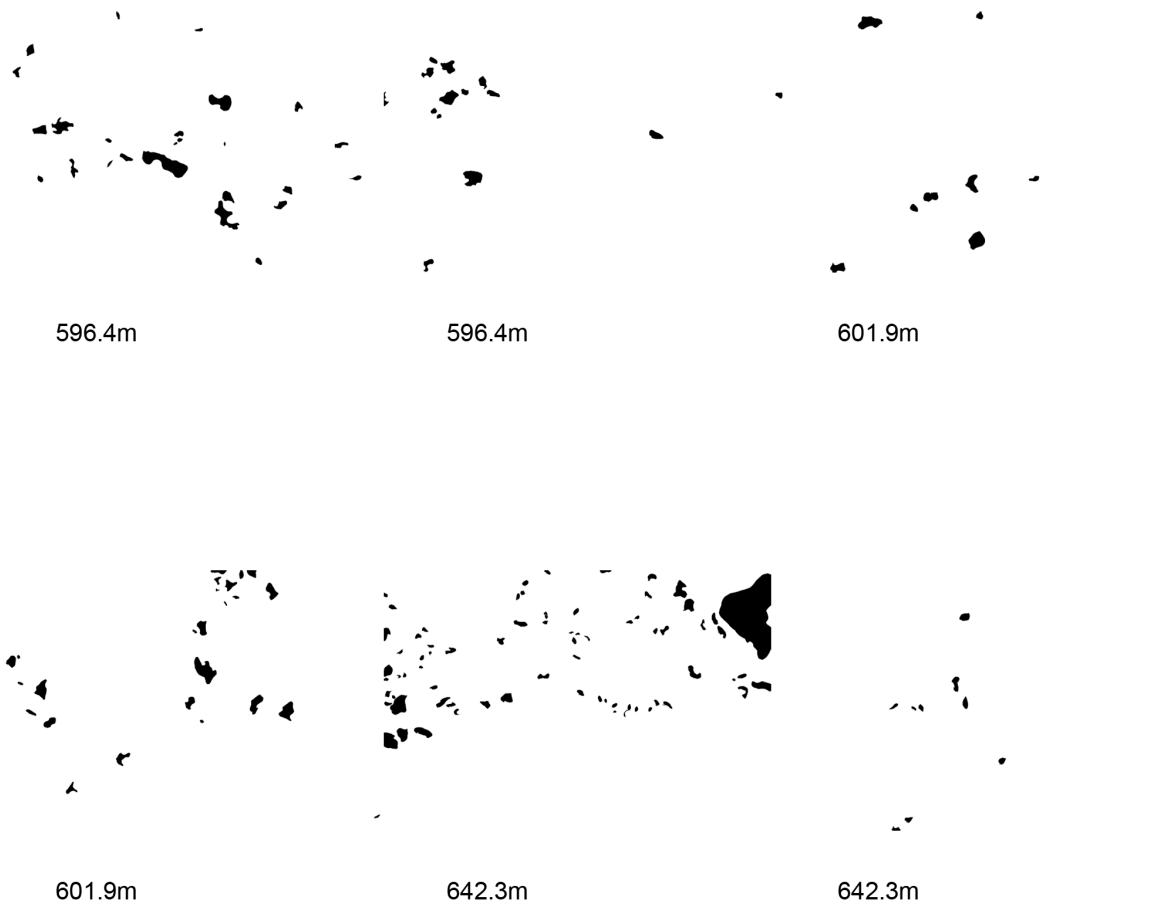


Fig. A.54.: SE templates of FBN73 (melt particles 596.4 - 642.3 m)

A. Appendix 1

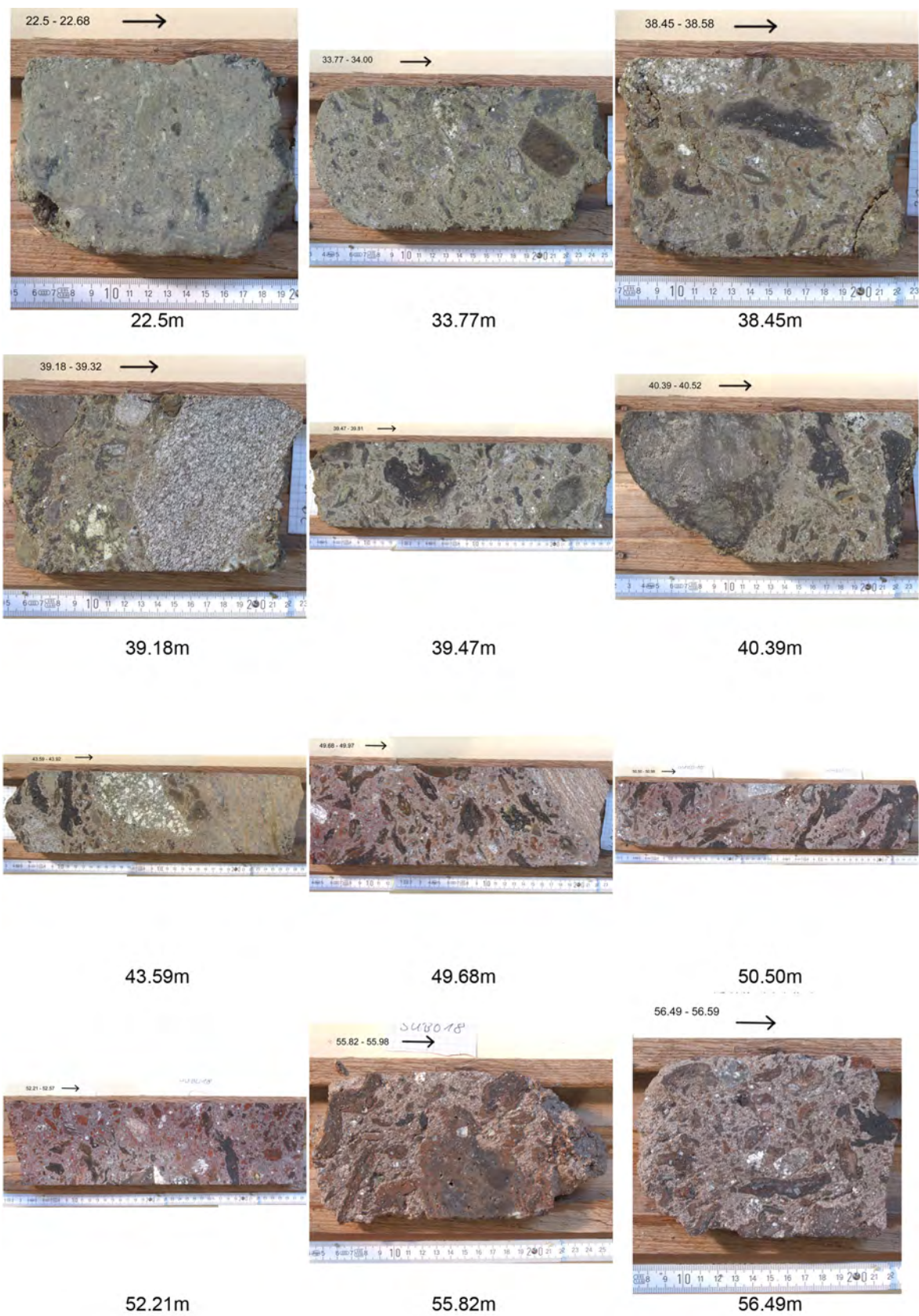


Fig. A.55.: Half core photographs of Enkingen (22.5 - 56.49 m)



Fig. A.56.: Half core photographs of Enkingen (58.17 - 70.19 m)

A. Appendix 1

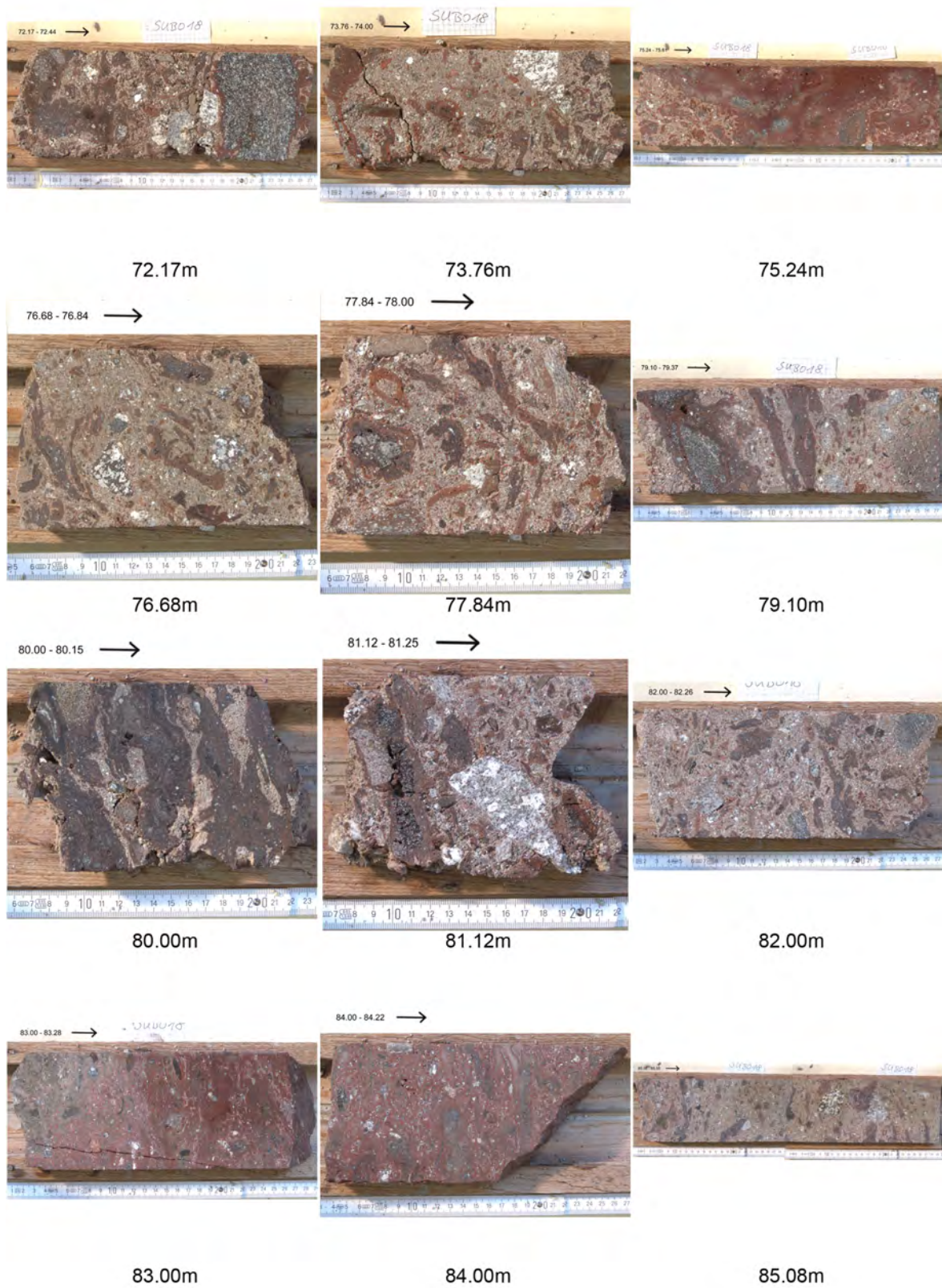


Fig. A.57.: Half core photographs of Enkingen (72.17 - 85.08 m)

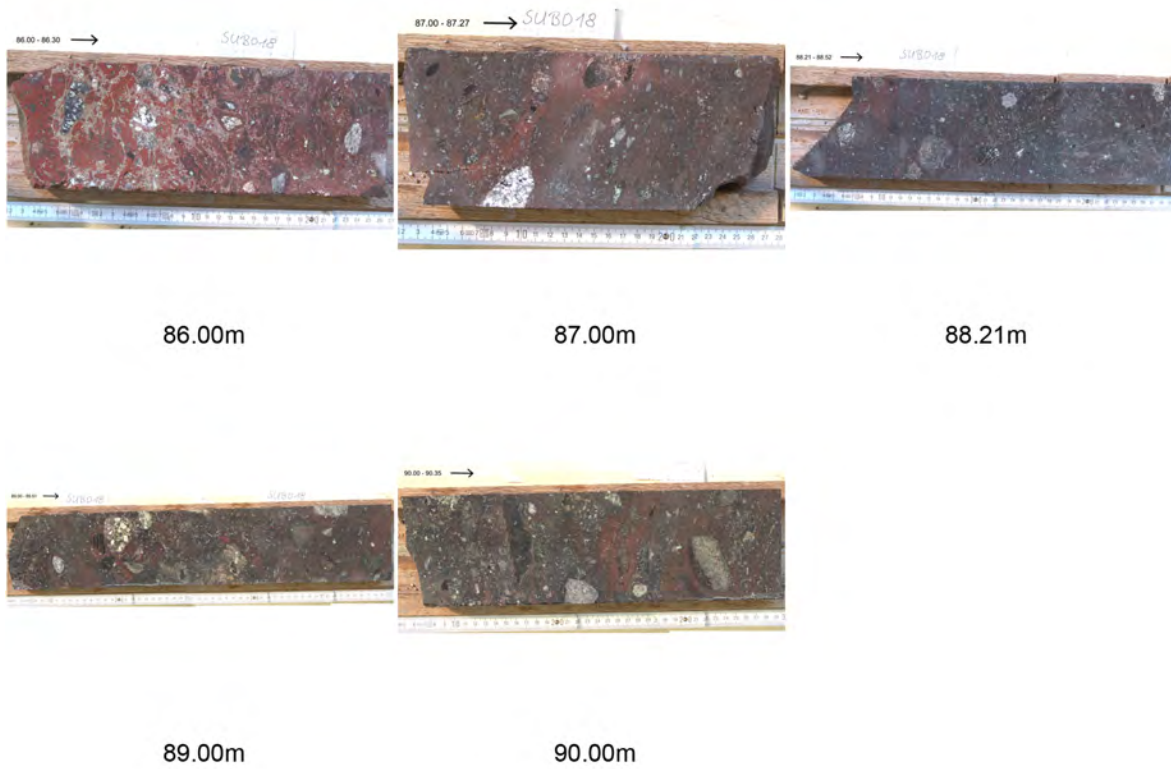


Fig. A.58.: Half core photographs of Enkingen (86.0 - 90.0 m)

A. Appendix 1

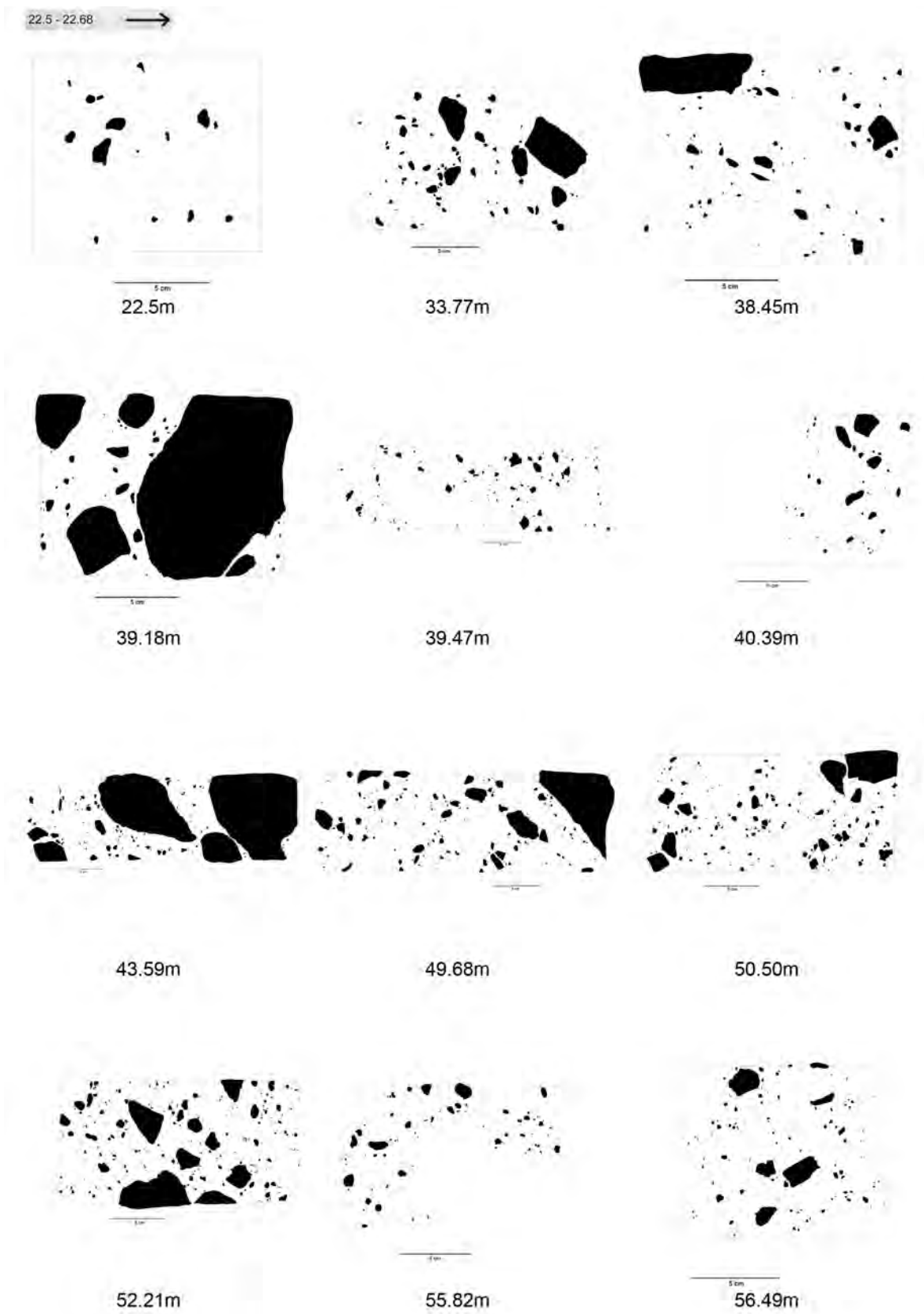


Fig. A.59.: Half core templates of Enkingen (lithic clasts 22.5 - 56.49 m)

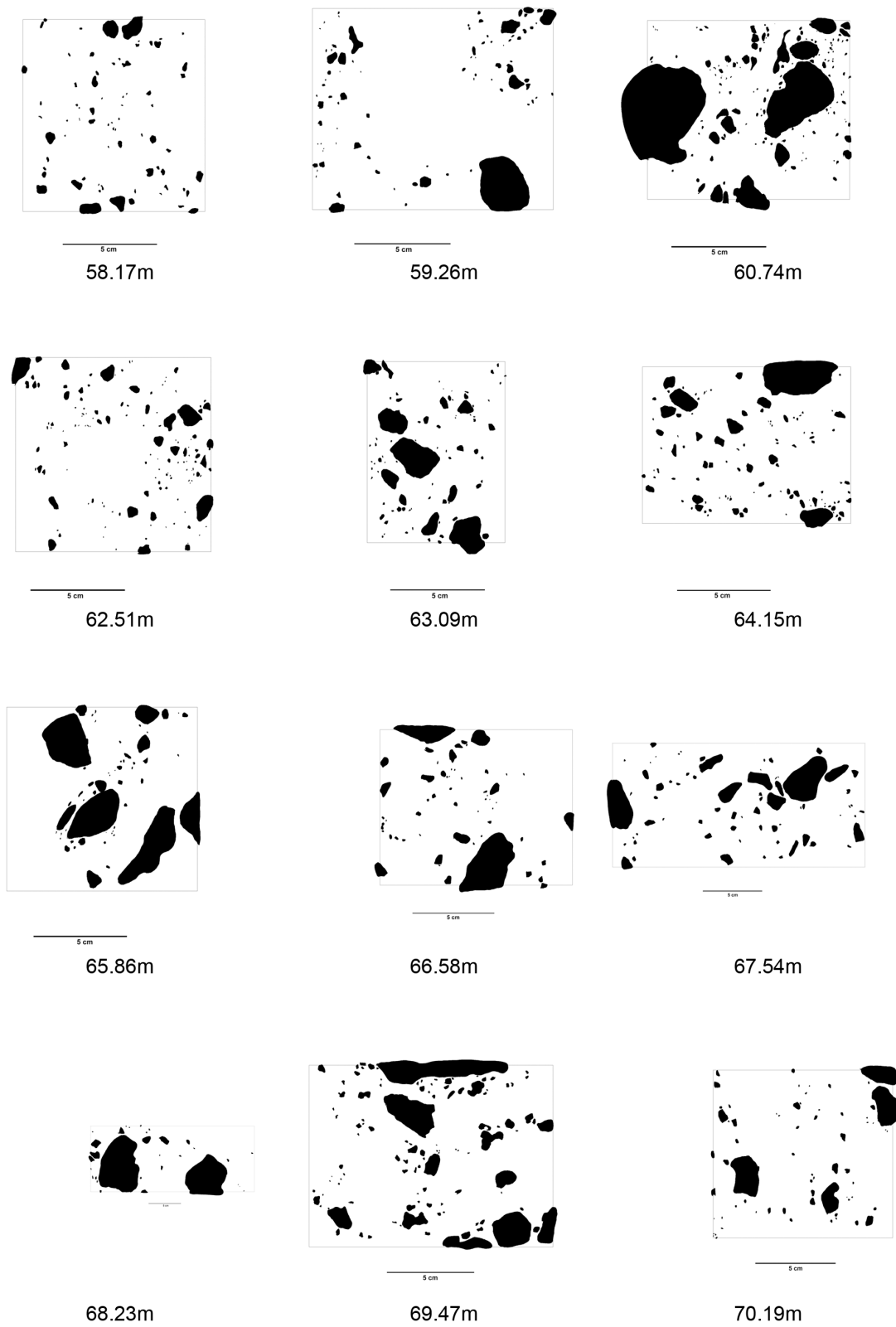


Fig. A.60.: Half core templates of Enkingen (lithic clasts 58.17 - 70.19 m)

A. Appendix 1

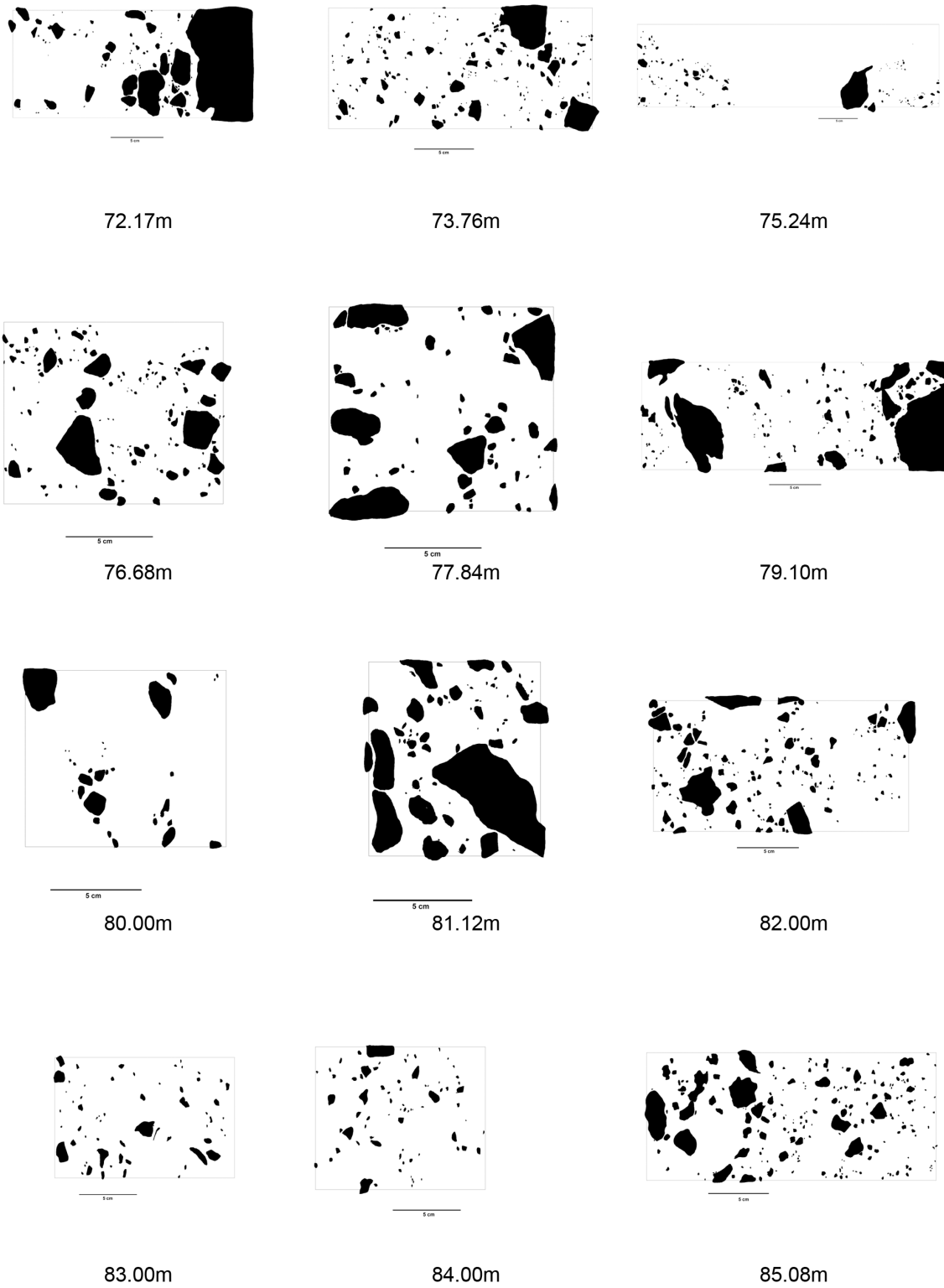


Fig. A.61.: Half core templates of Enkingen (lithic clasts 72.17 - 85.08 m)

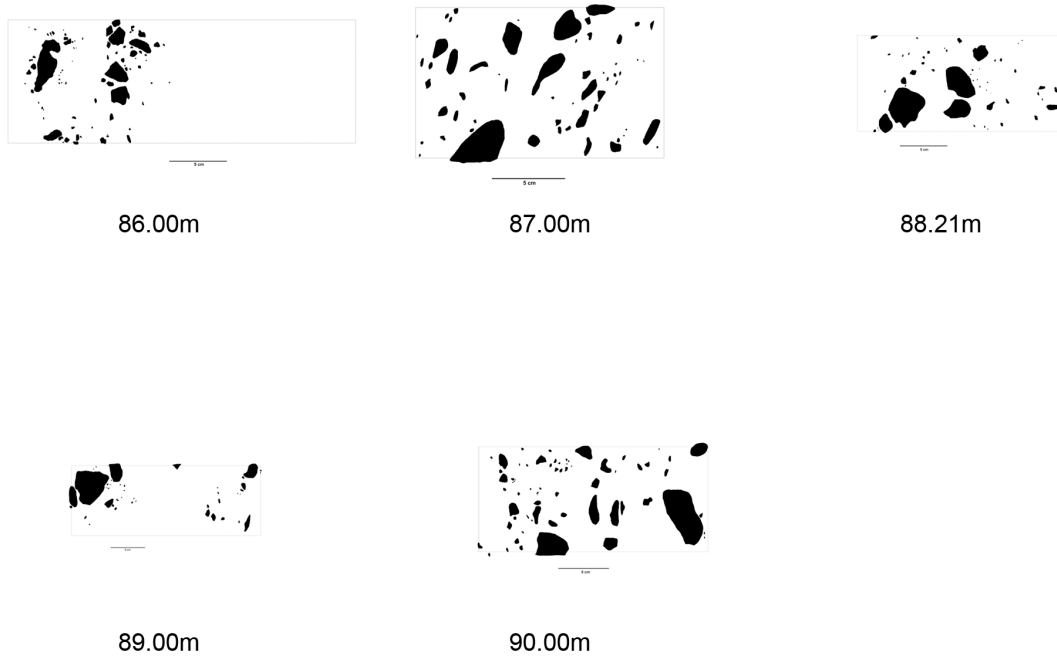


Fig. A.62.: Half core templates of Enkingen (lithic clasts 86.0 - 90.0 m)

A. Appendix 1

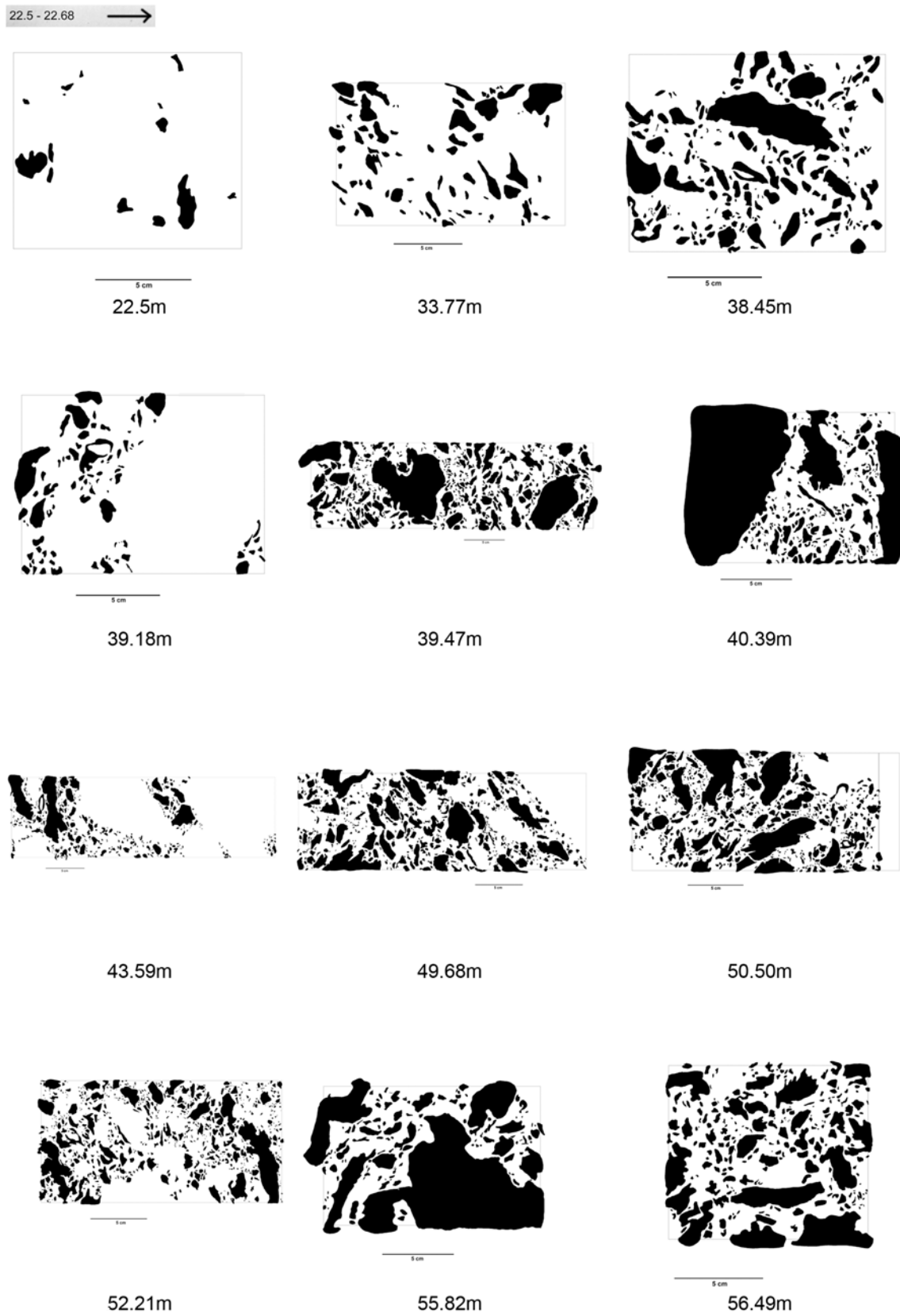


Fig. A.63.: Half core templates of Enkingen (melt particles 22.5 - 56.49 m)

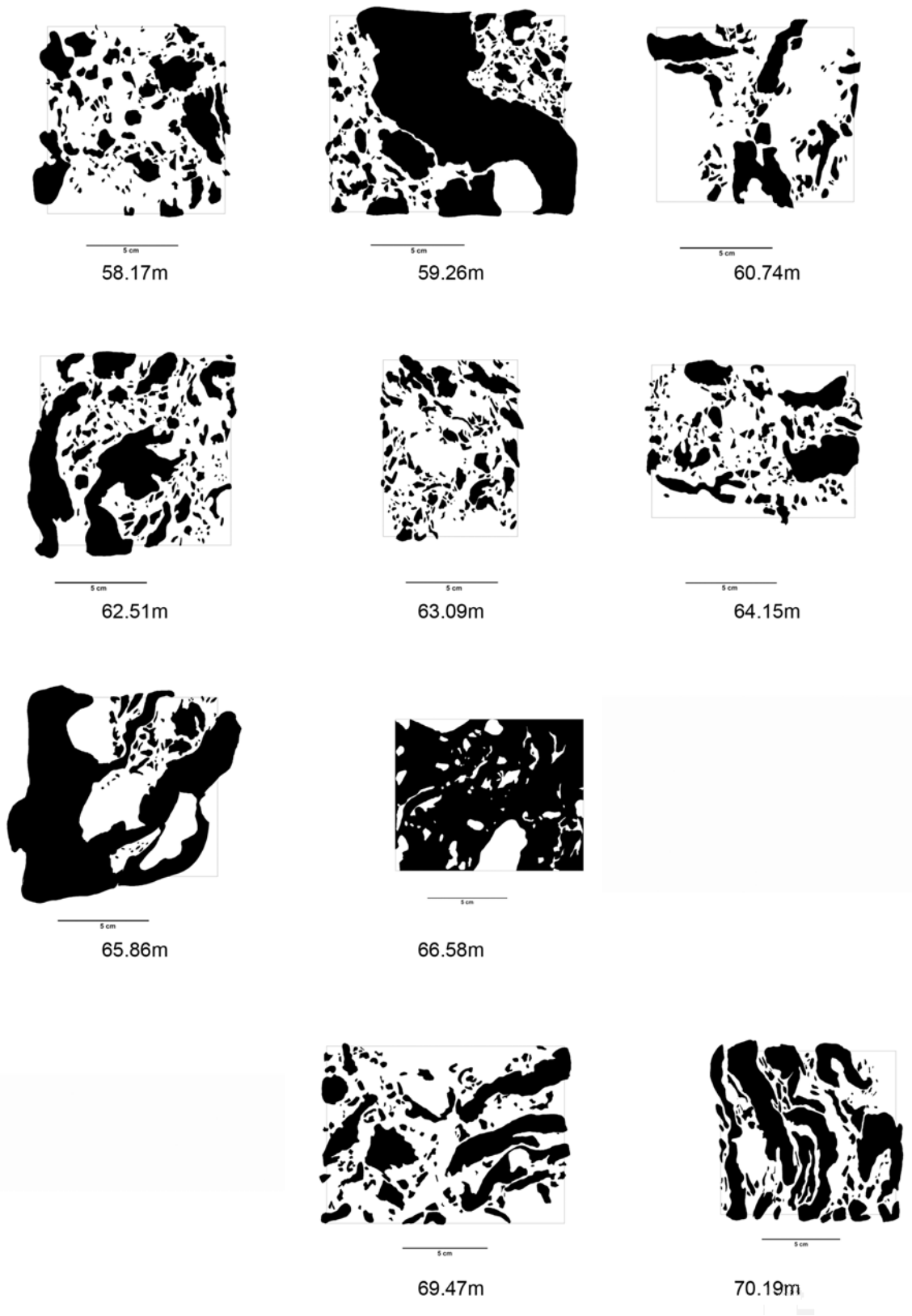


Fig. A.64.: Half core templates of Enkingen (melt particles 58.17 - 70.19 m)

A. Appendix 1

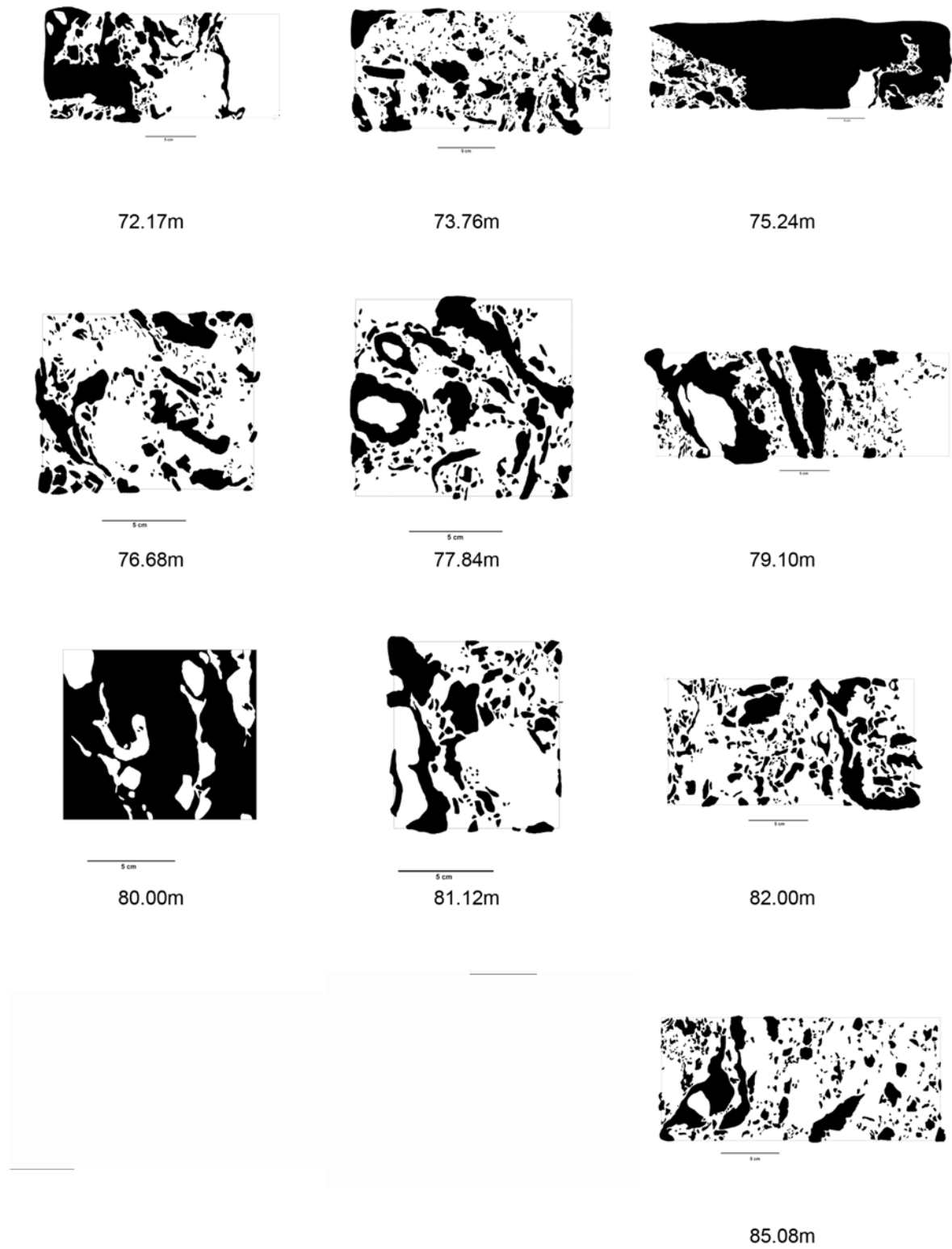


Fig. A.65.: Half core templates of Enkingen (melt particles 72.17 - 85.08 m)



Fig. A.66.: Half core templates of Enkingen (melt particles 86.0 m)

A. Appendix 1

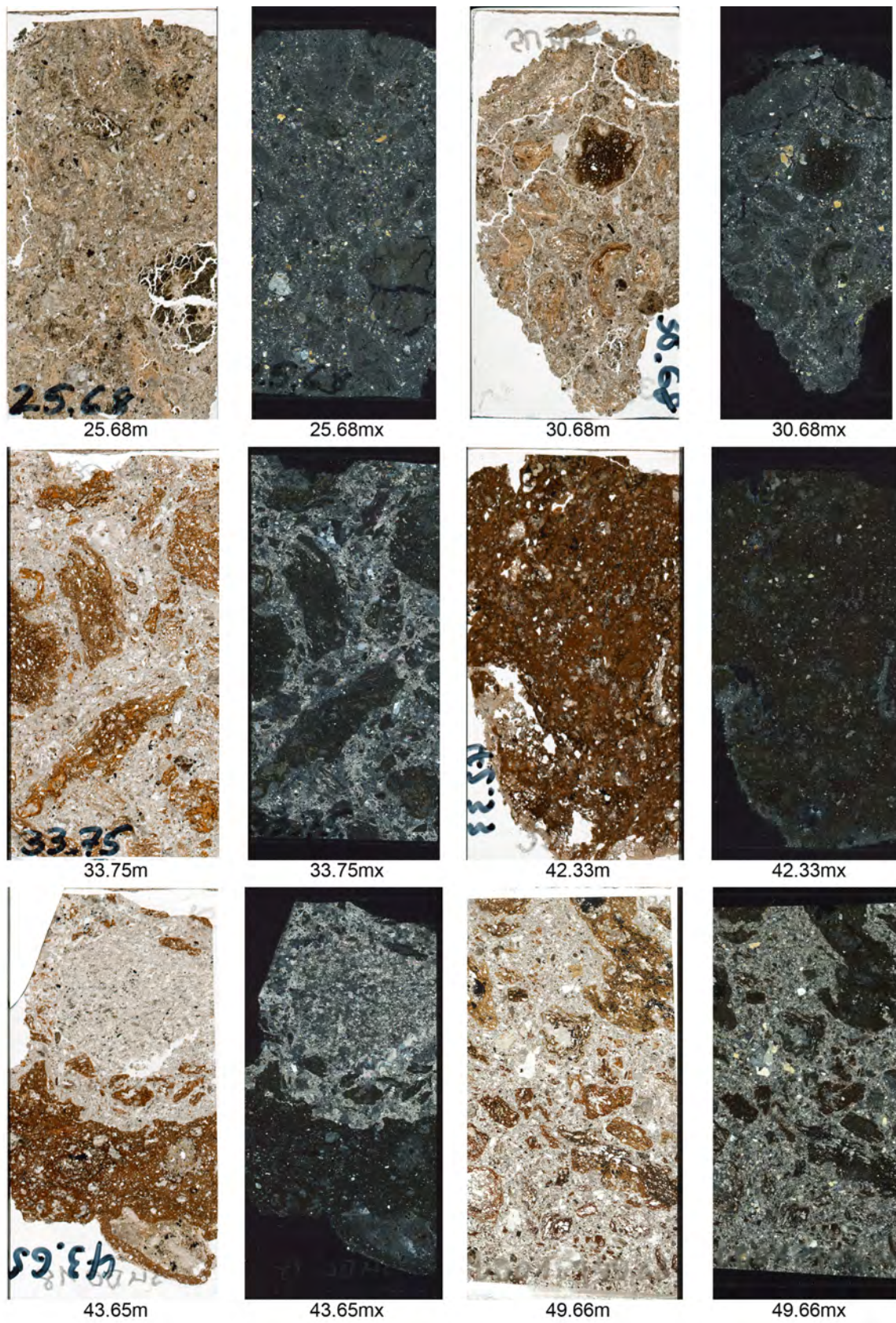


Fig. A.67.: Thin section photographs of Enkingen (25.68 - 49.66 m)

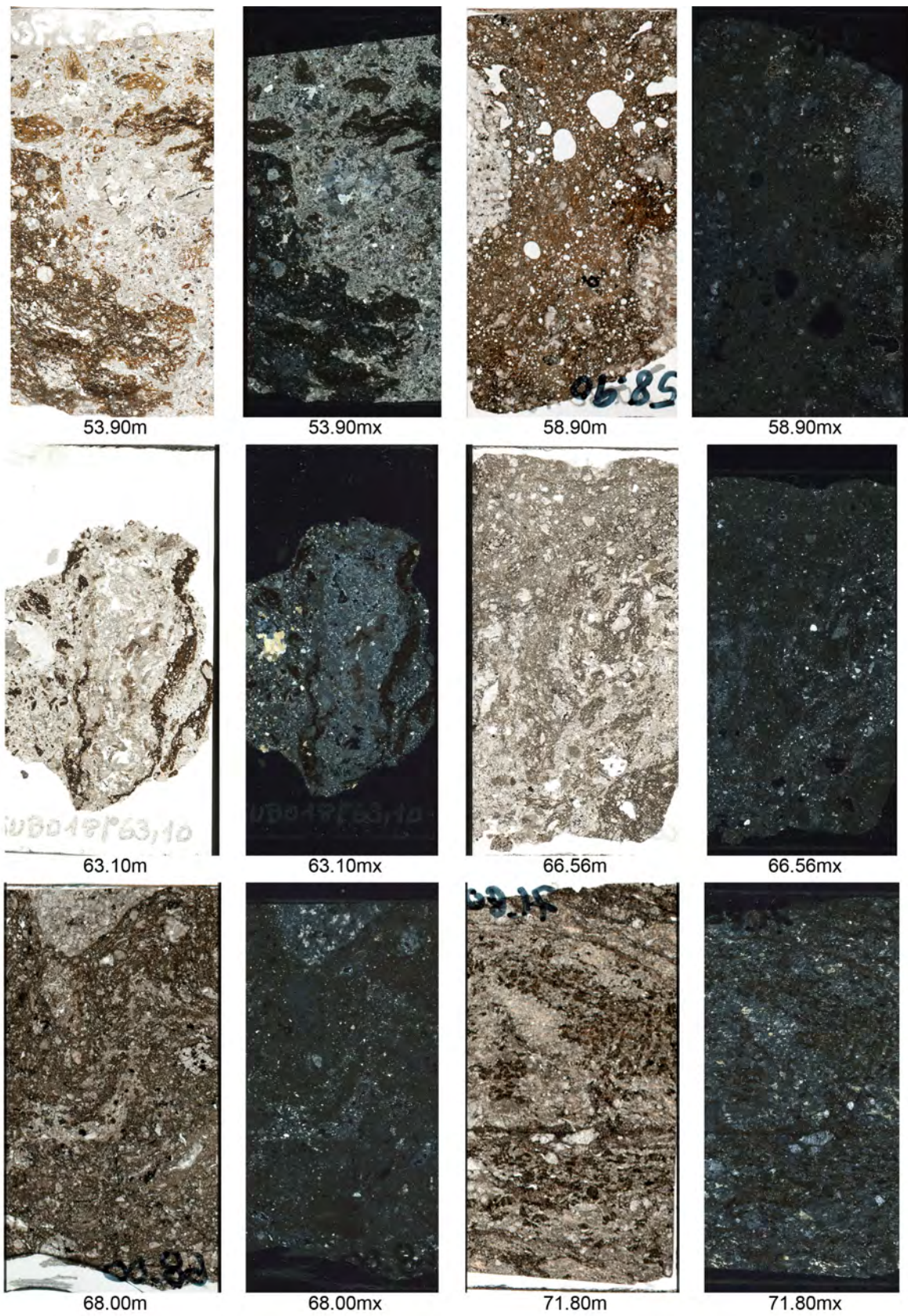


Fig. A.68.: Thin section photographs of Enkingen (53.90 - 71.80 m)

A. Appendix 1

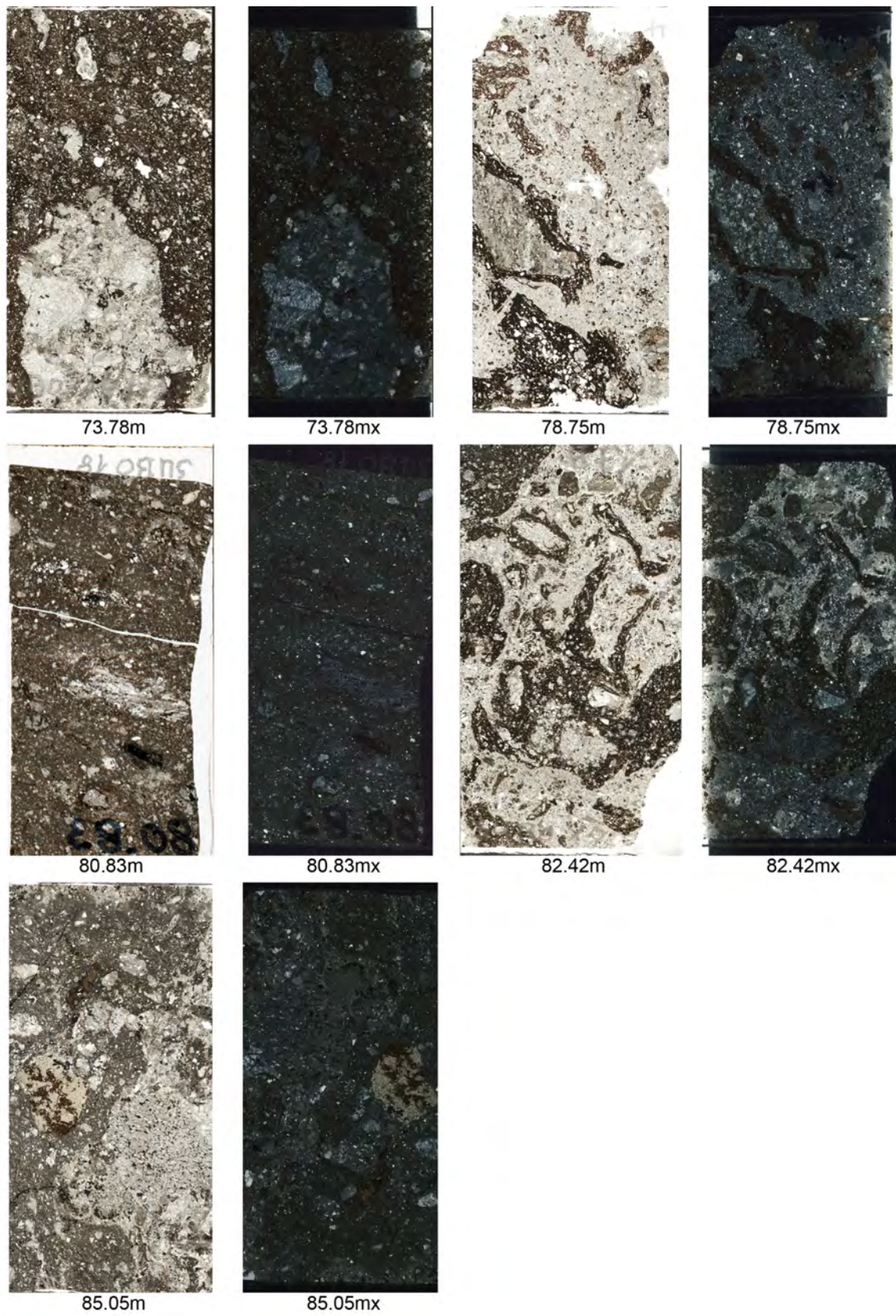


Fig. A.69.: Thin section photographs of Enkingen (73.78 - 85.05 m)

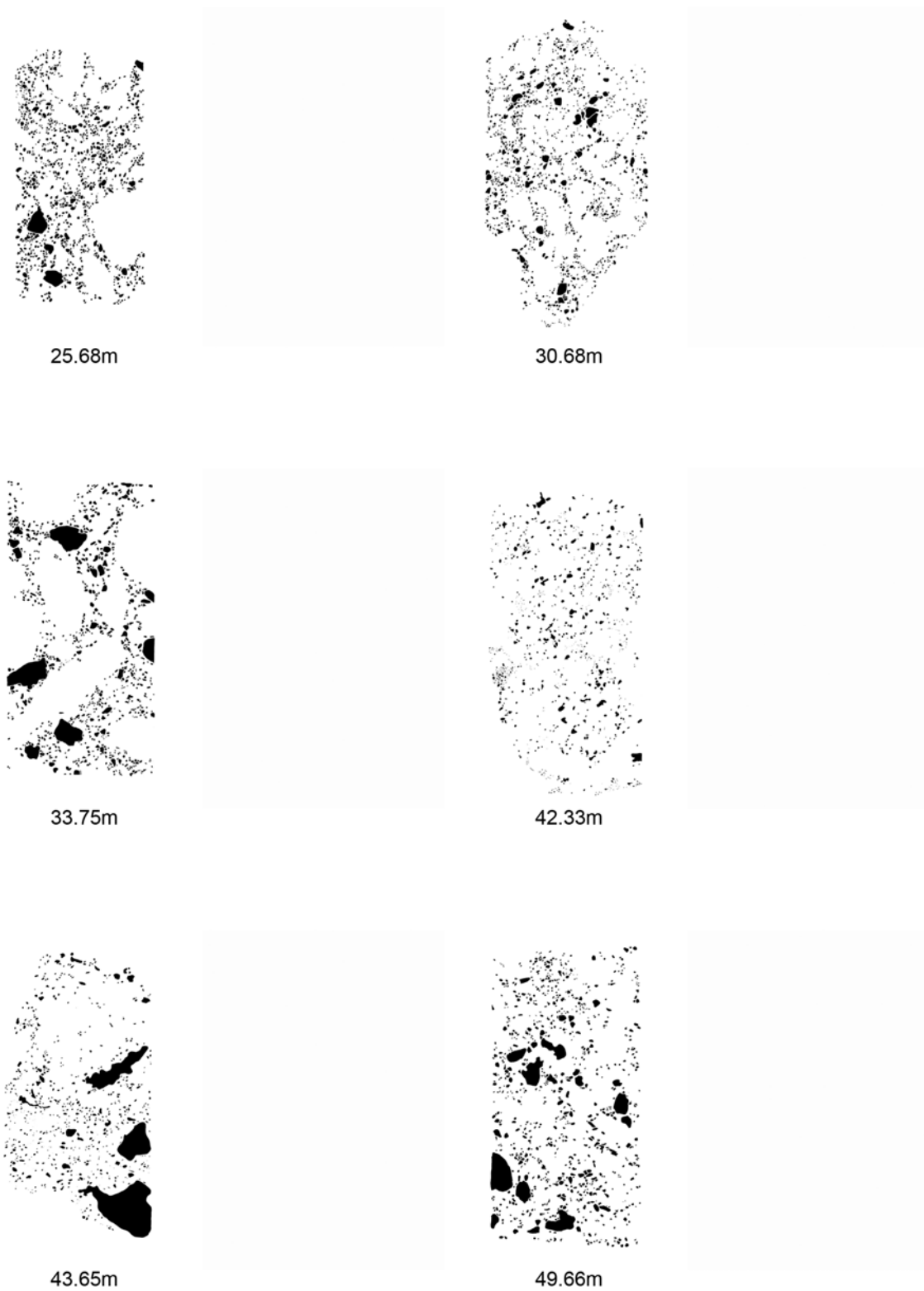


Fig. A.70.: Thin section templates of Enkingen (lithic clasts 25.68 - 49.66 m)

A. Appendix 1

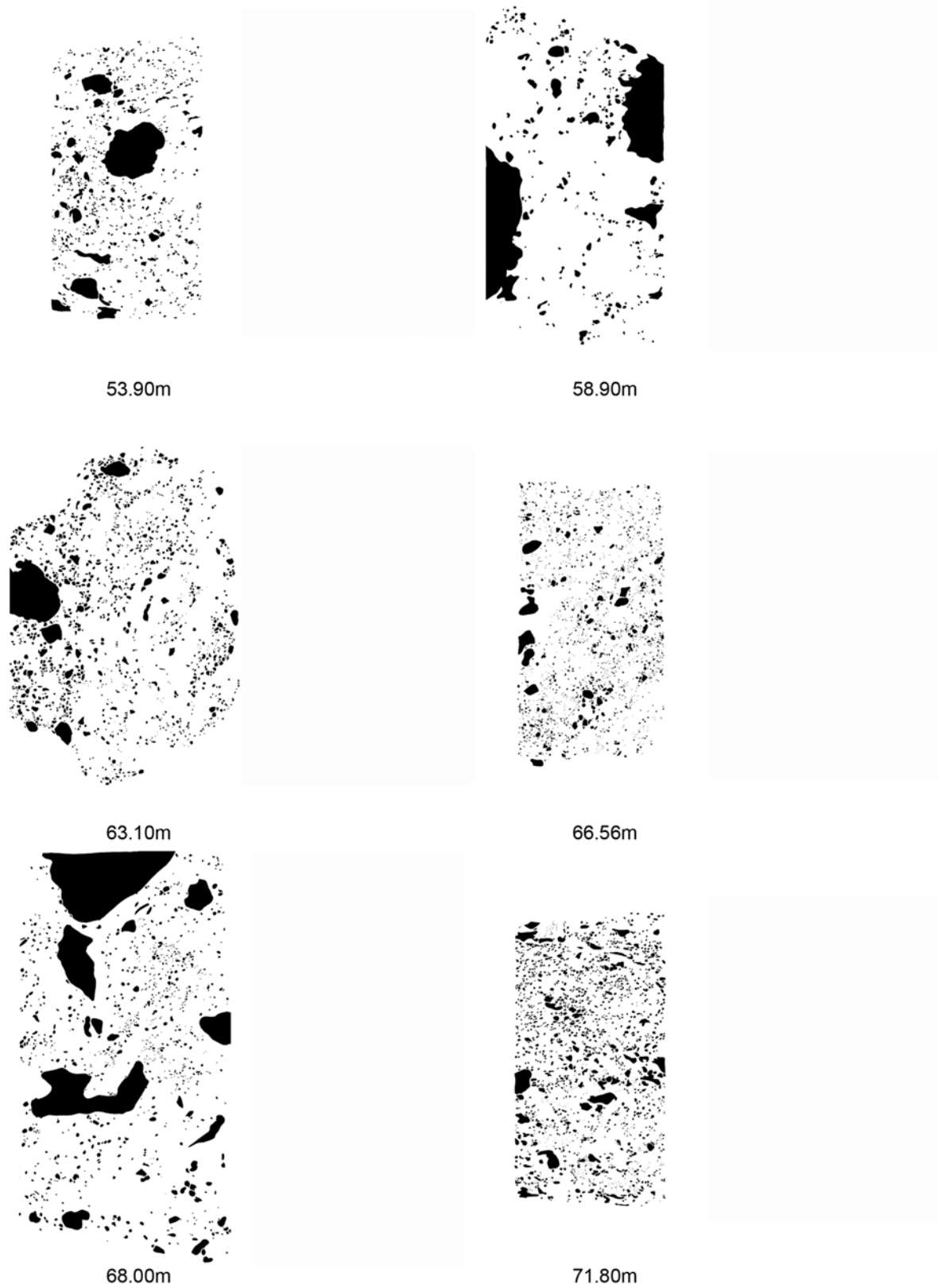


Fig. A.71.: Thin section templates of Enkingen (lithic clasts 53.90 - 71.80 m)

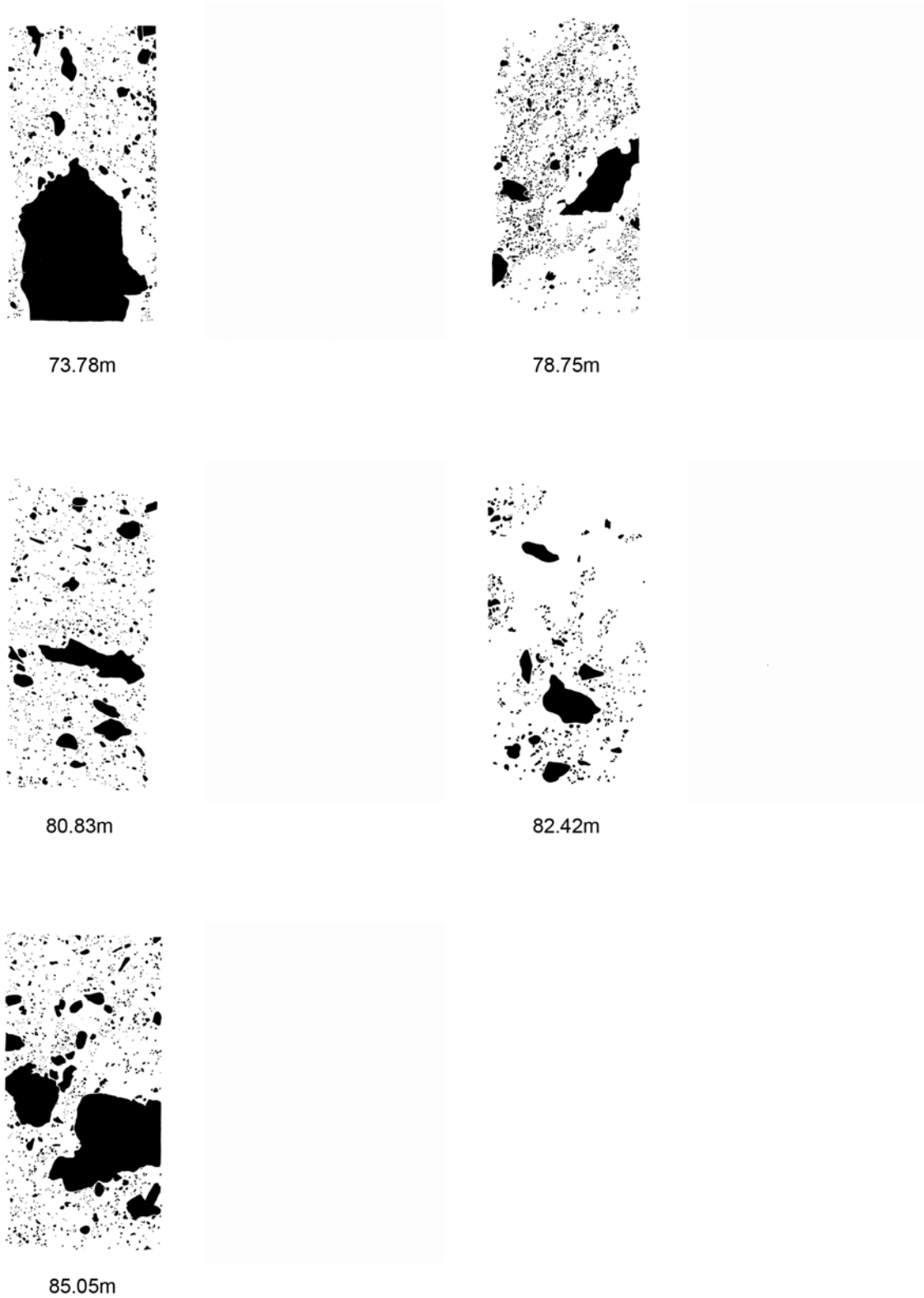


Fig. A.72.: Thin section templates of Enkingen (lithic clasts 73.78 - 85.05 m)

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25.68m



30.68m



33.75m



42.33m



43.65m



49.66m

Fig. A.73.: Thin section templates of Enkingen (melt particles 25.68 - 49.66 m)



Fig. A.74.: Thin section templates of Enkingen (melt particles 53.90 - 71.80 m)

A. Appendix 1



73.78m



78.75m



80.83m

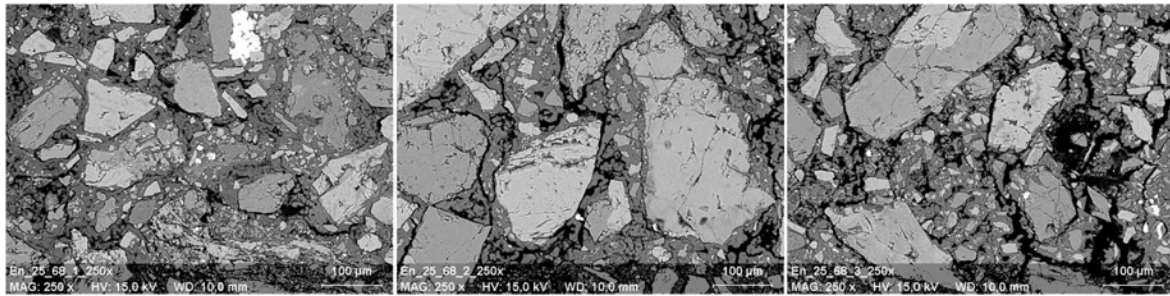


82.42m



85.05m

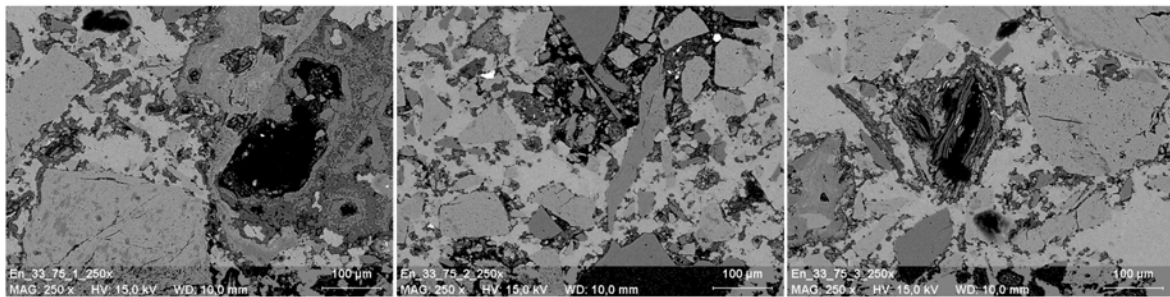
Fig. A.75.: Thin section templates of Enkingen (melt particles 73.78 - 85.05 m)



25.68m

25.68m

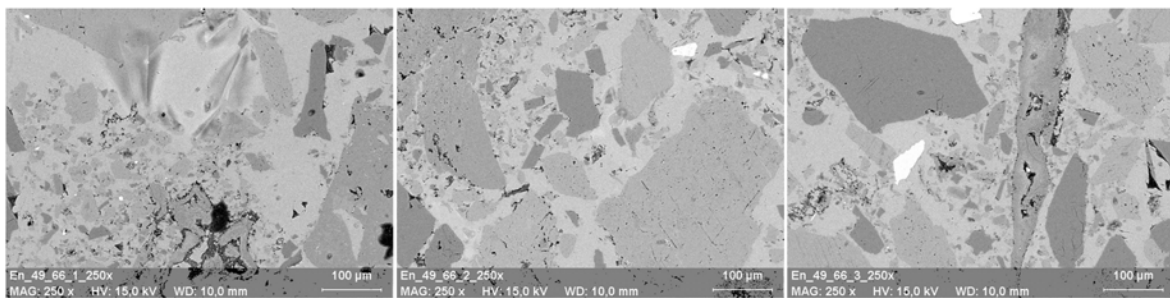
25.68m



33.75m

33.75m

33.75m



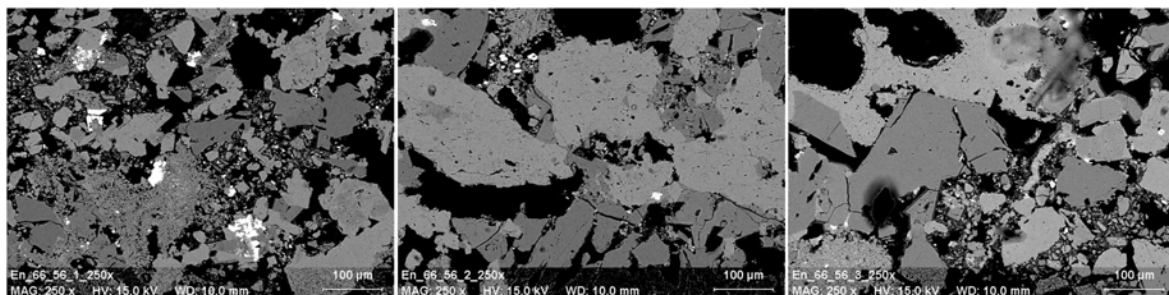
49.66m

49.66m

49.66m

Fig. A.76.: SE pictures of Enkingen (25.68 - 49.66 m)

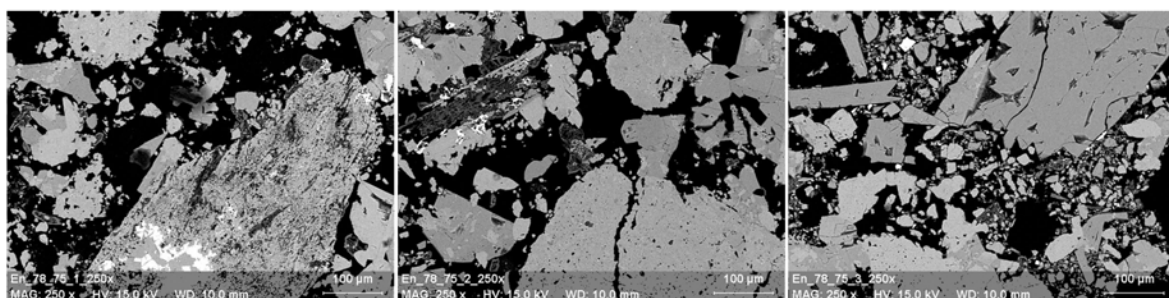
A. Appendix 1



66.56m

66.56m

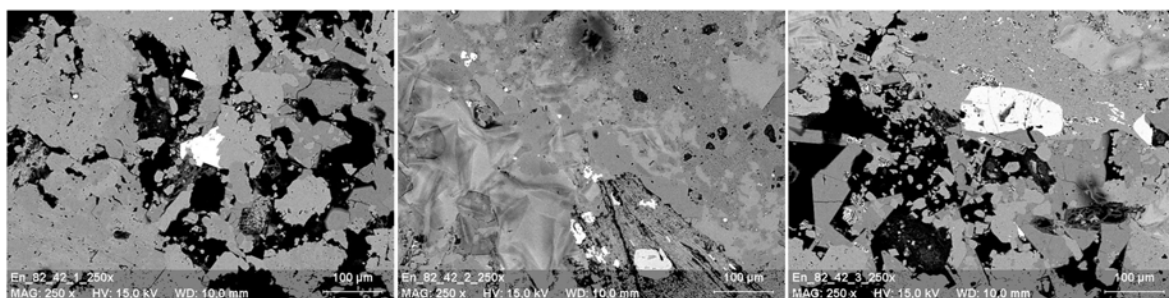
66.56m



78.75m

78.75m

78.75m

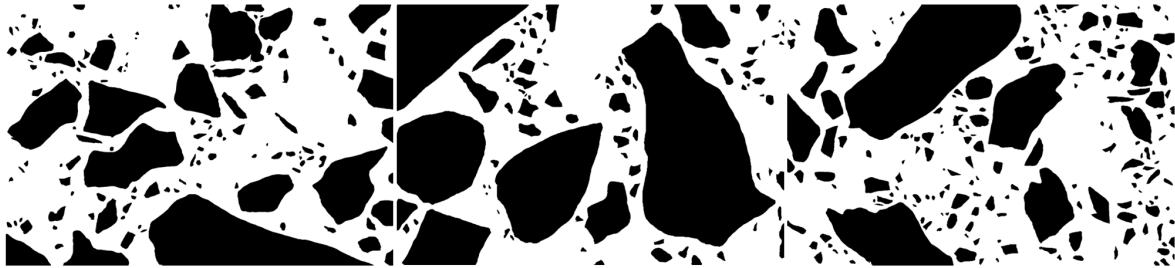


82.42m

82.42m

82.42m

Fig. A.77.: SE pictures of Enkingen (66.56 - 82.42 m)



25.68m

25.68m

25.68m



33.75m

33.75m

33.75m



49.66m

49.66m

49.66m

Fig. A.78.: SE templates of Enkingen (lithic clasts 25.68 - 49.66 m)



66.56m

66.56m

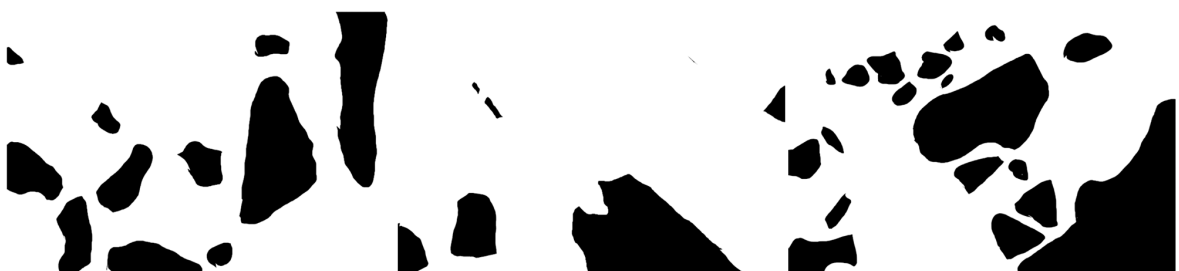
66.56m



78.75m

78.75m

78.75m



82.42m

82.42m

82.42m

Fig. A.79.: SE templates of Enkingen (lithic clasts 66.56 - 82.42 m)

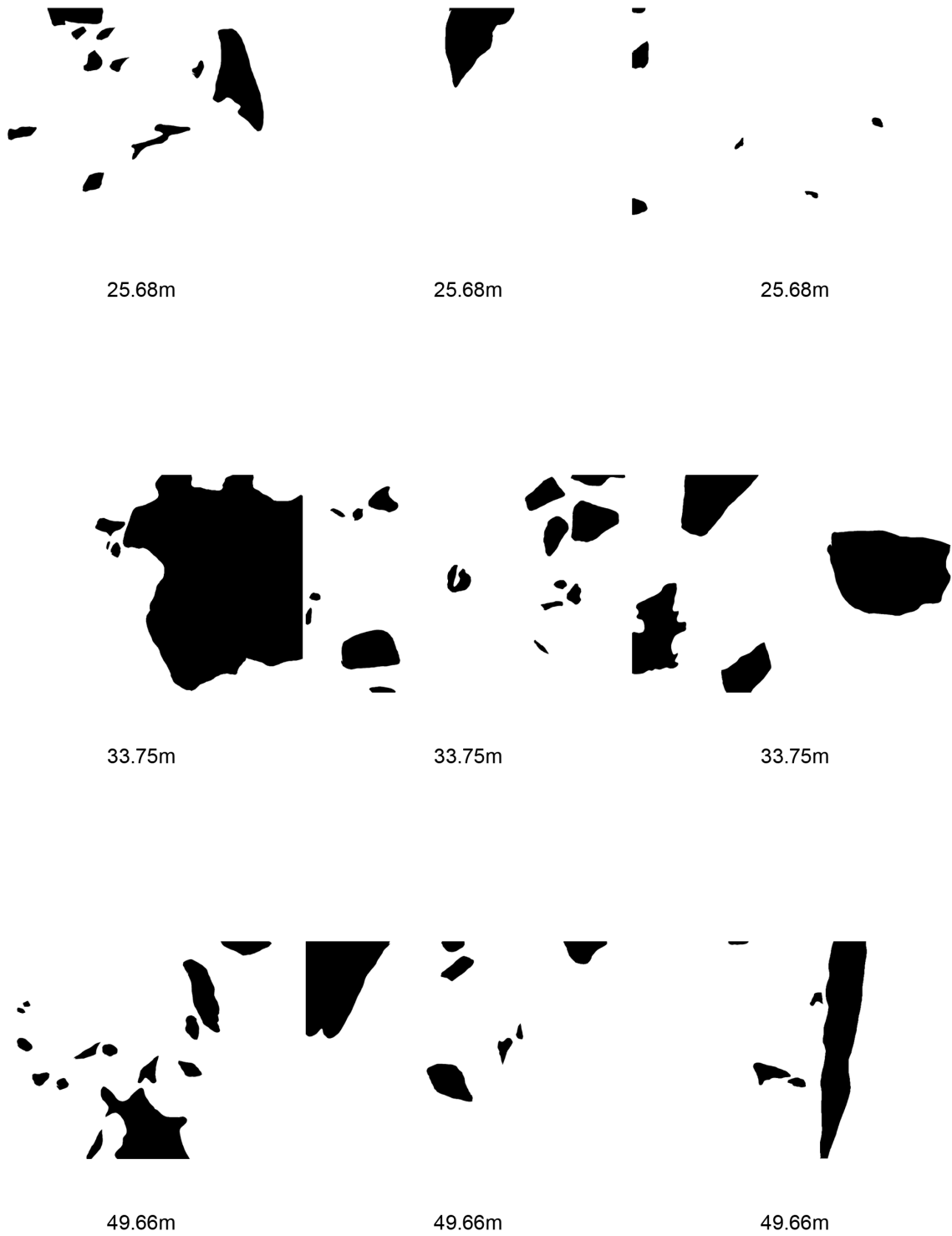


Fig. A.80.: SE templates of Enkingen (melt particles 25.68 - 49.66 m)

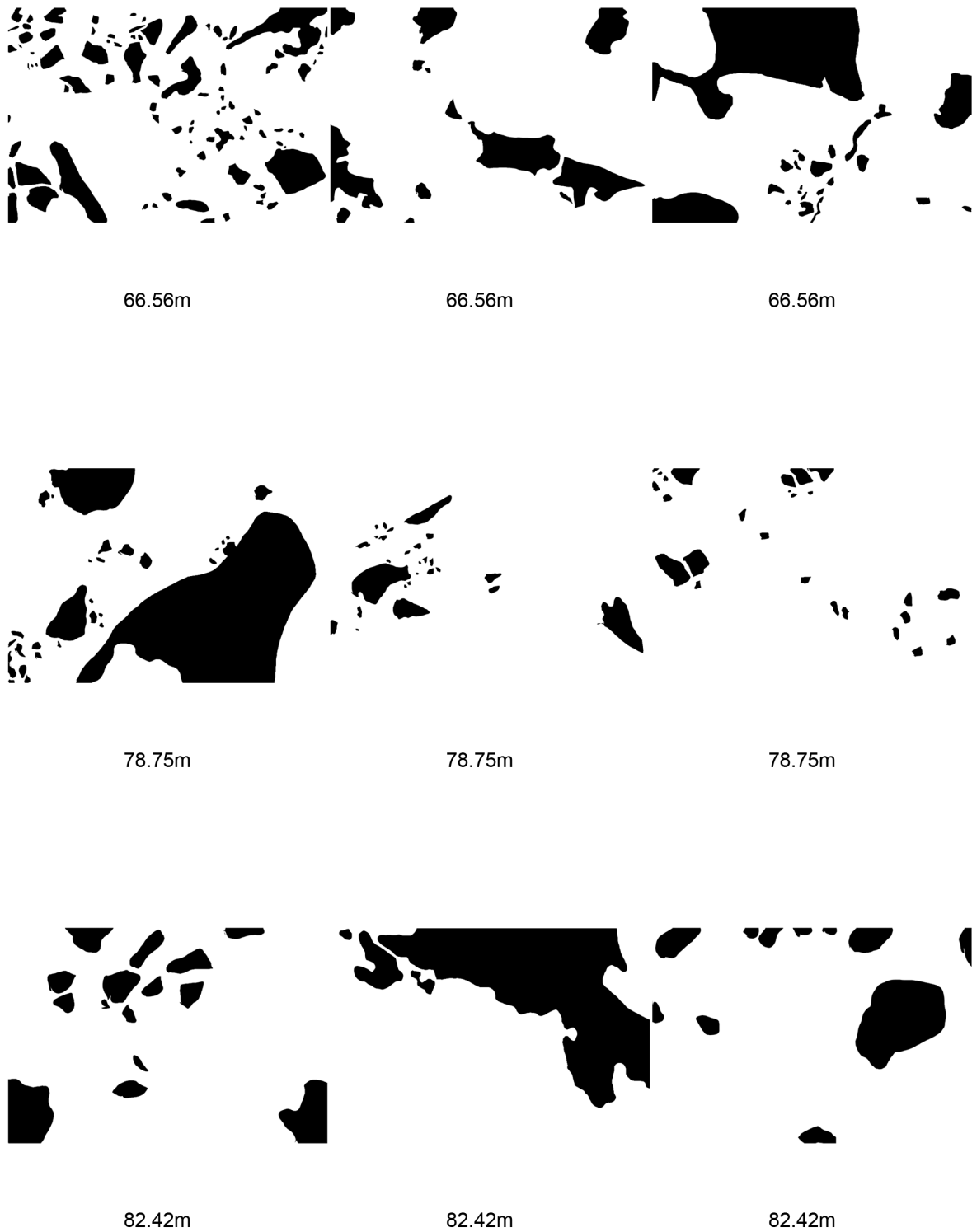


Fig. A.81.: SE templates of Enkingen (melt particles 66.56 - 82.42 m)

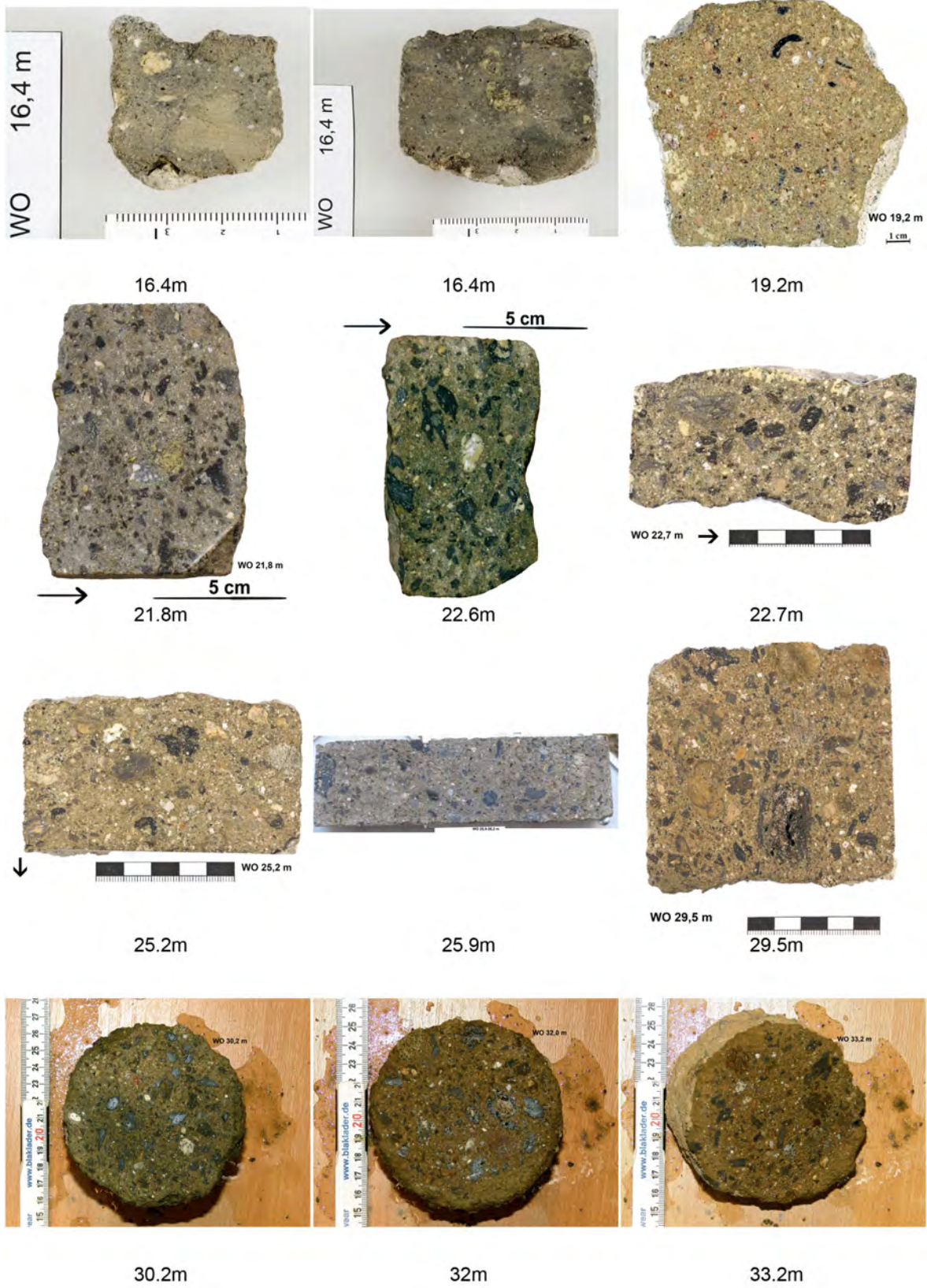


Fig. A.82.: Half core photographs of Wörnitzostheim (16.4 - 33.2 m)

A. Appendix 1

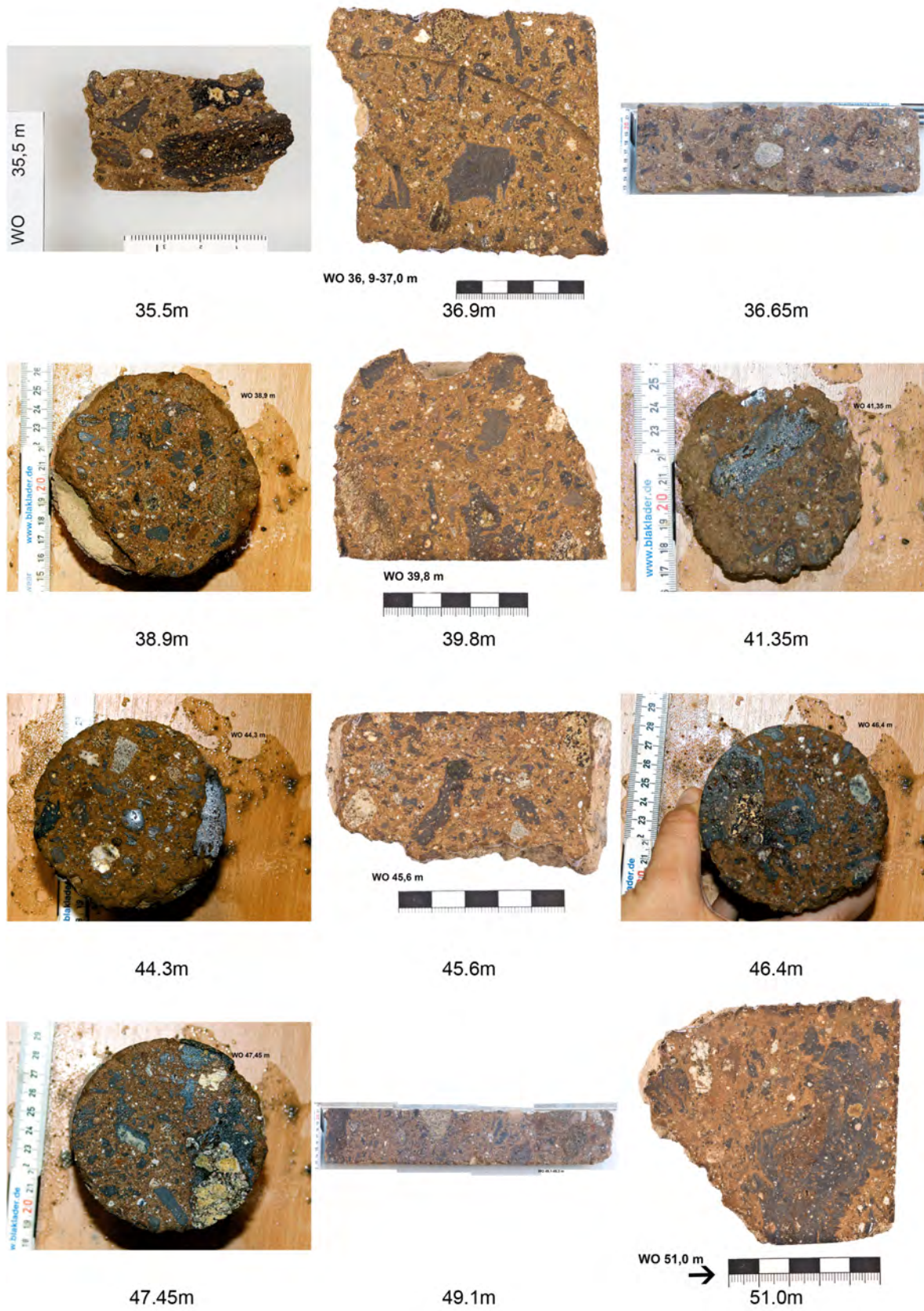


Fig. A.83.: Half core photographs of Wörnitzostheim (35.5 - 51.0 m)

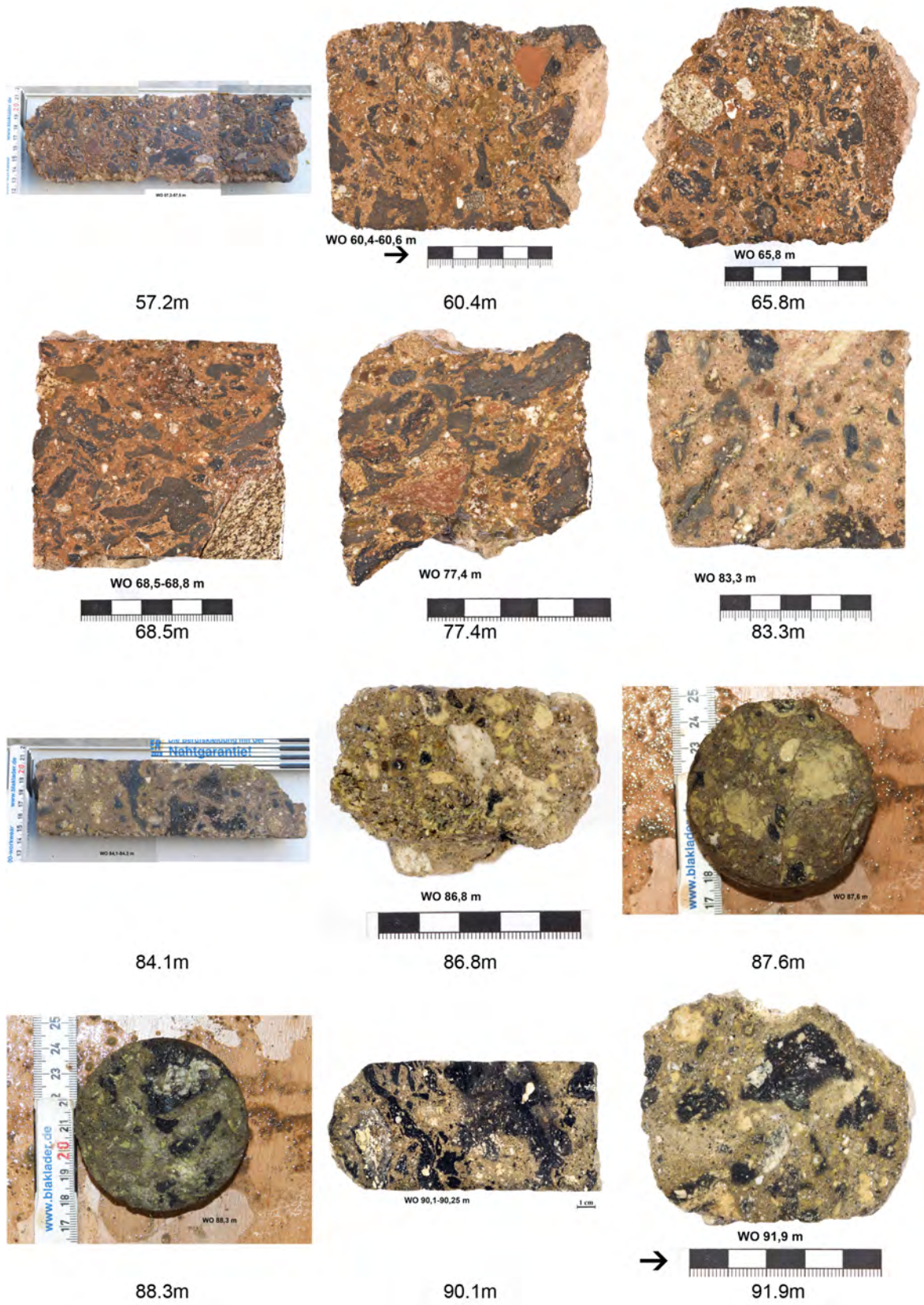


Fig. A.84.: Half core photographs of Wörnitzostheim 57.2 - 91.9 m)

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Fig. A.85.: Half core photographs of Wörnitzostheim (95.2 - 98.5 m)

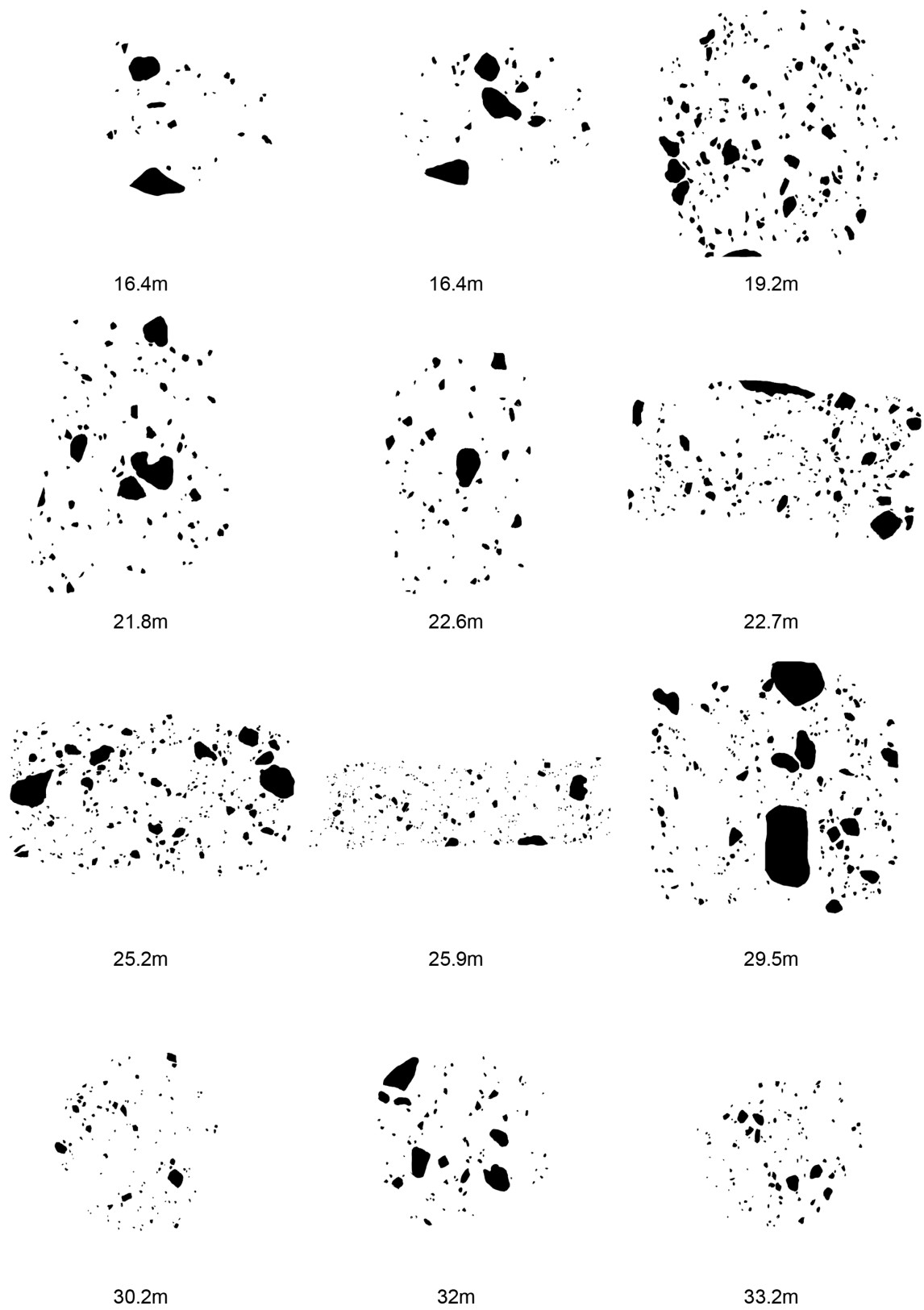


Fig. A.86.: Half core templates of Wörnitzostheim (lithic clasts 16.4 - 33.2 m)

A. Appendix 1

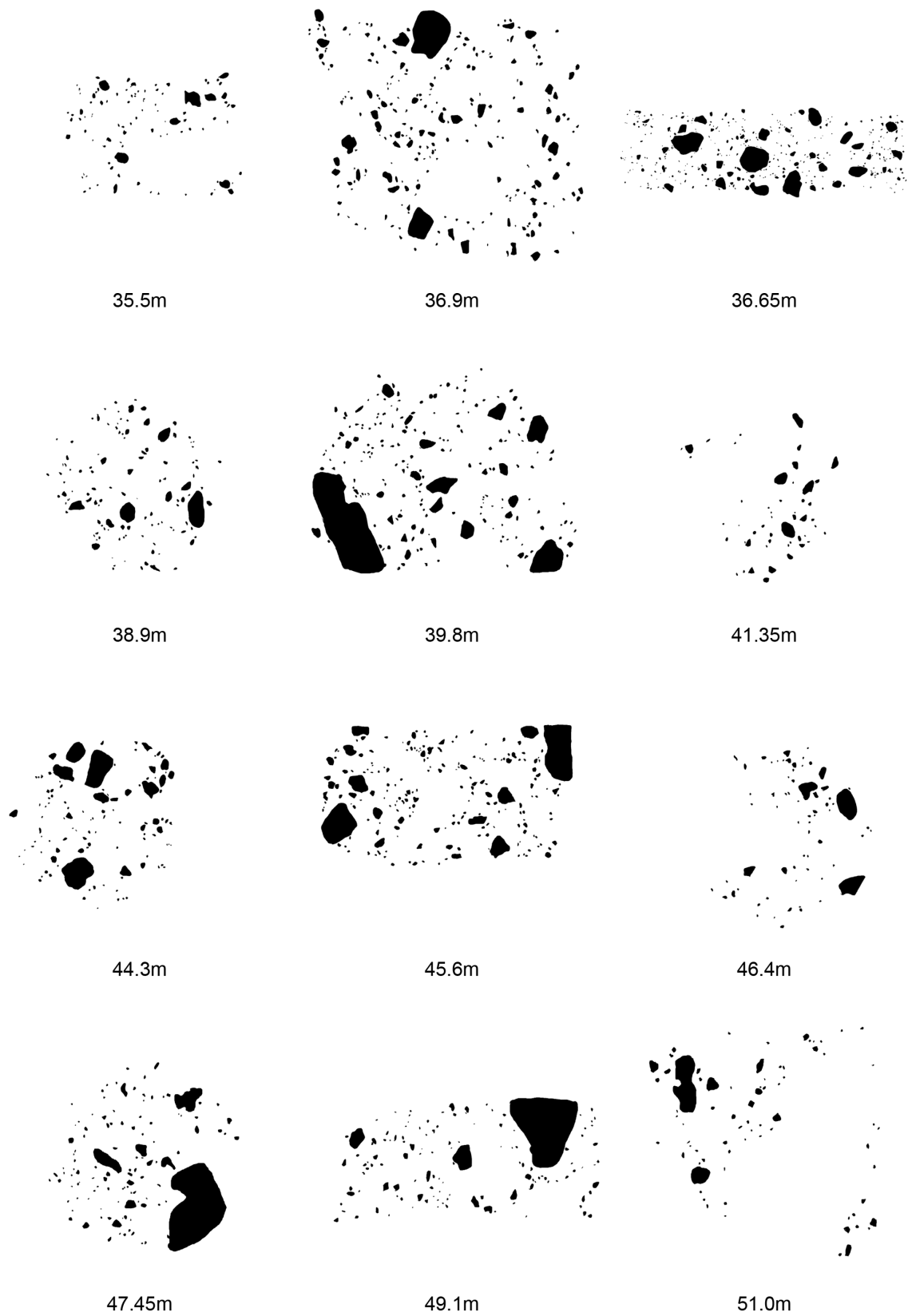


Fig. A.87.: Half core templates of Wörnitzostheim (lithic clasts 35.5 - 51.0 m)

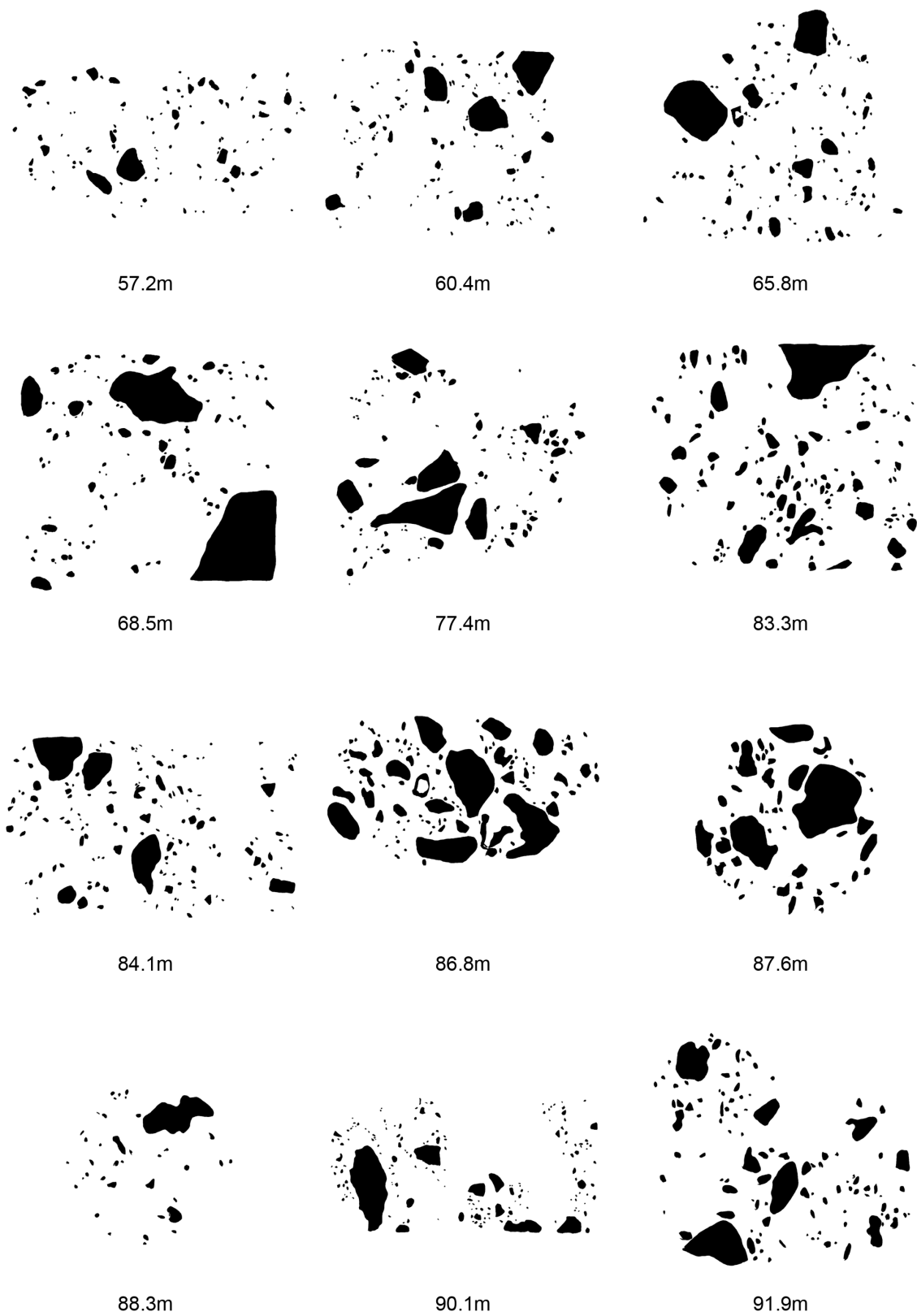


Fig. A.88.: Half core templates of Wörnitzostheim (lithic clasts 57.2 - 91.9 m)

A. Appendix 1

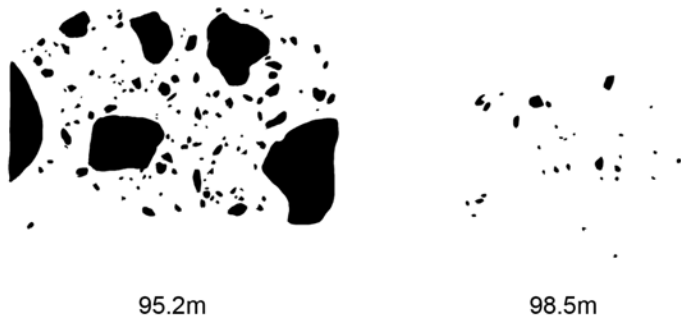


Fig. A.89.: Half core templates of Wörnitzostheim (lithic clasts 95.2 - 98.5 m)

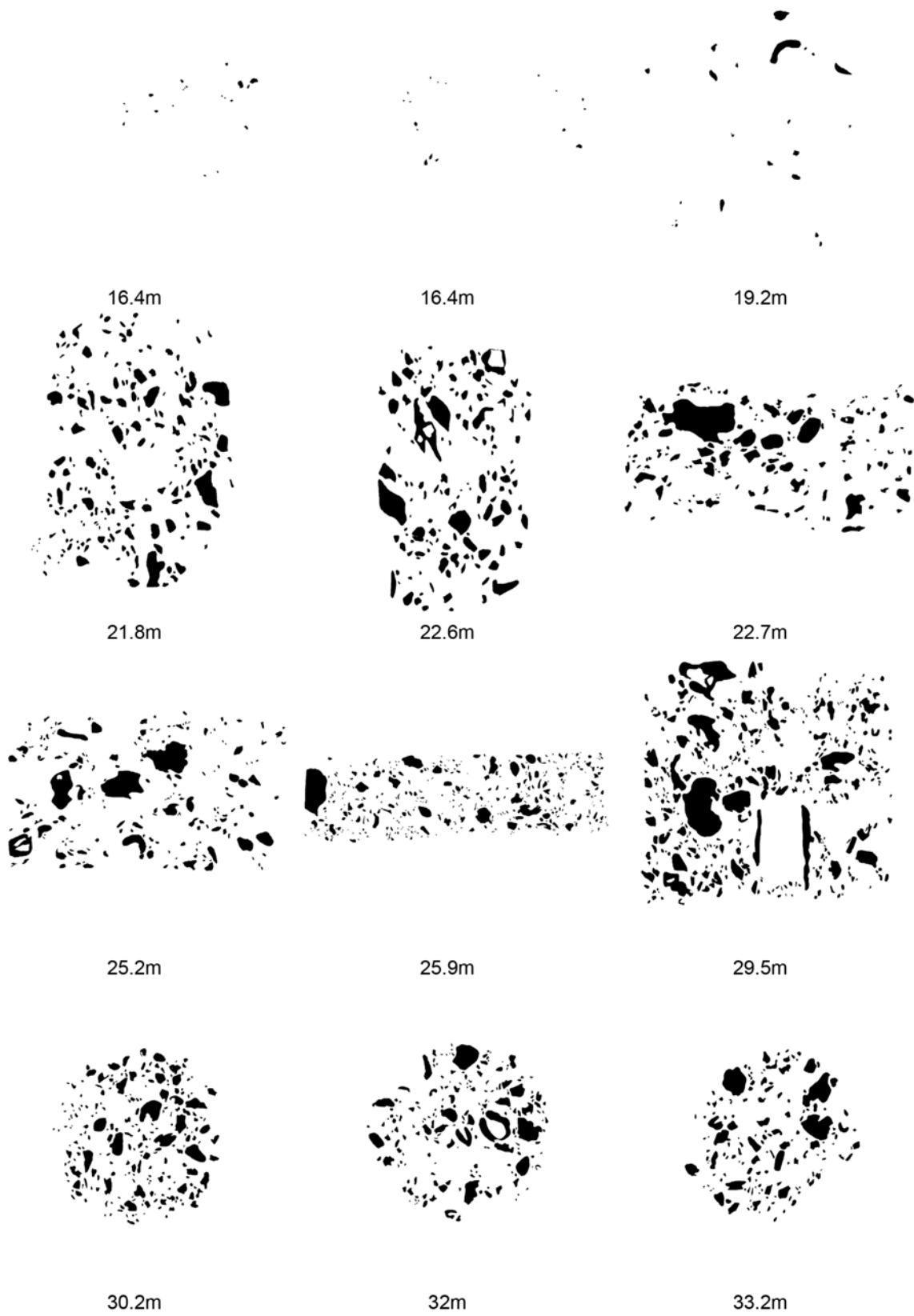


Fig. A.90.: Half core templates of Wörmitzostheim (melt particles 16.4 - 33.2 m)

A. Appendix 1

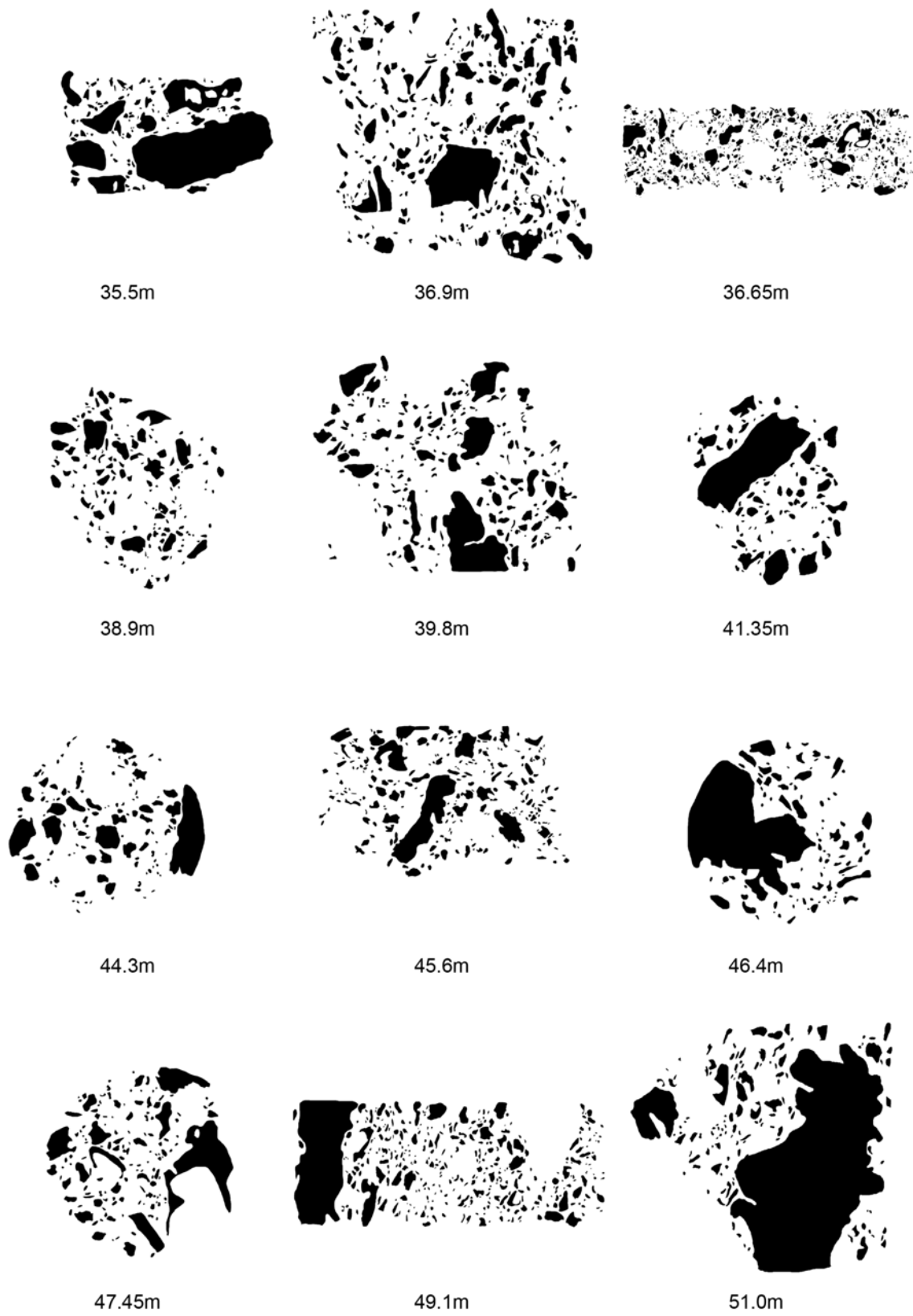


Fig. A.91.: Half core templates of Wörnitzostheim (melt particles 35.5 - 51.0 m)

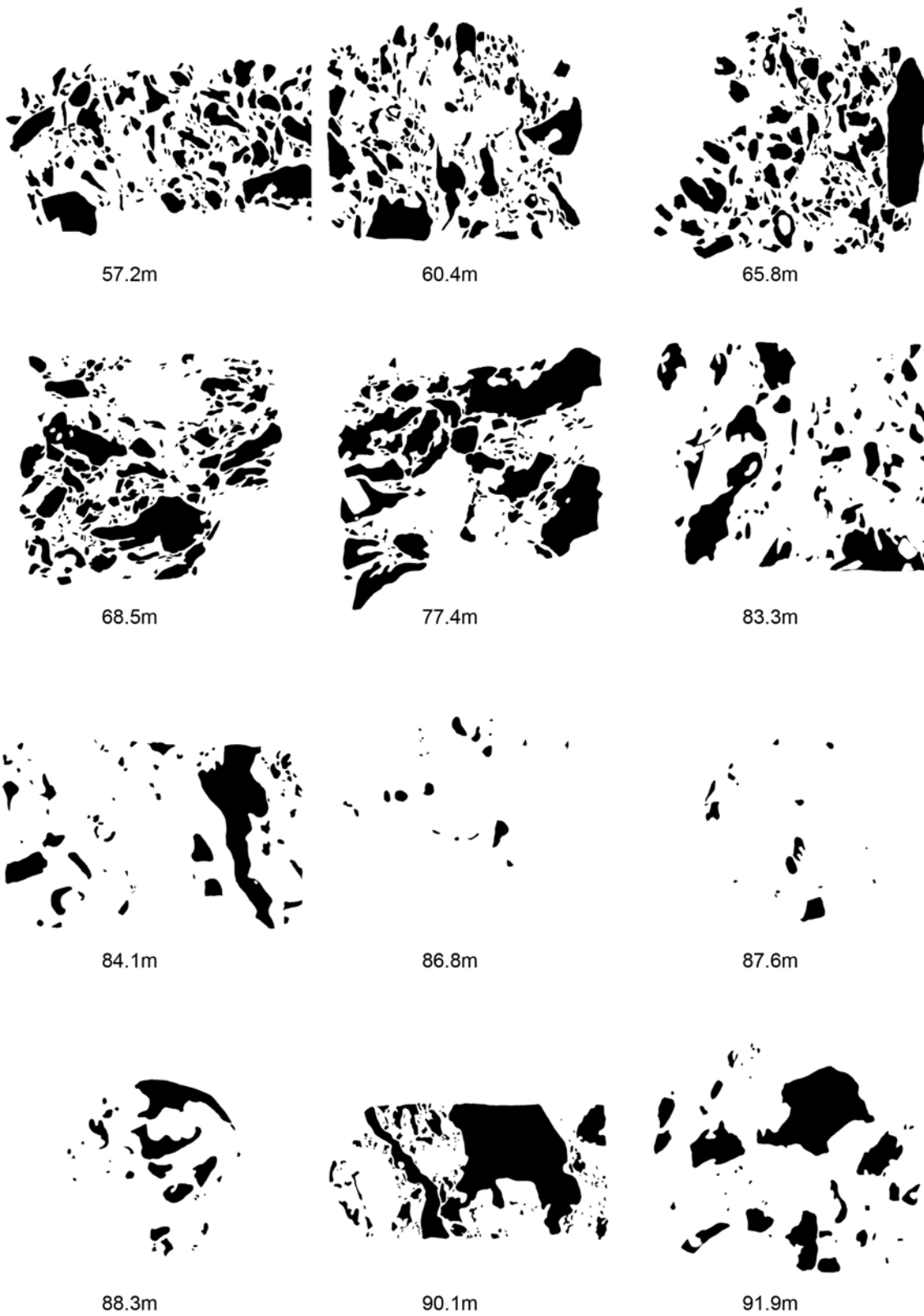


Fig. A.92.: Half core templates of Wörnitzostheim (melt particles 57.2 - 91.9 m)

A. Appendix 1



95.2m



98.5m

Fig. A.93.: Half core templates of Wörnitzostheim (melt particles 95.2 - 98.5 m)

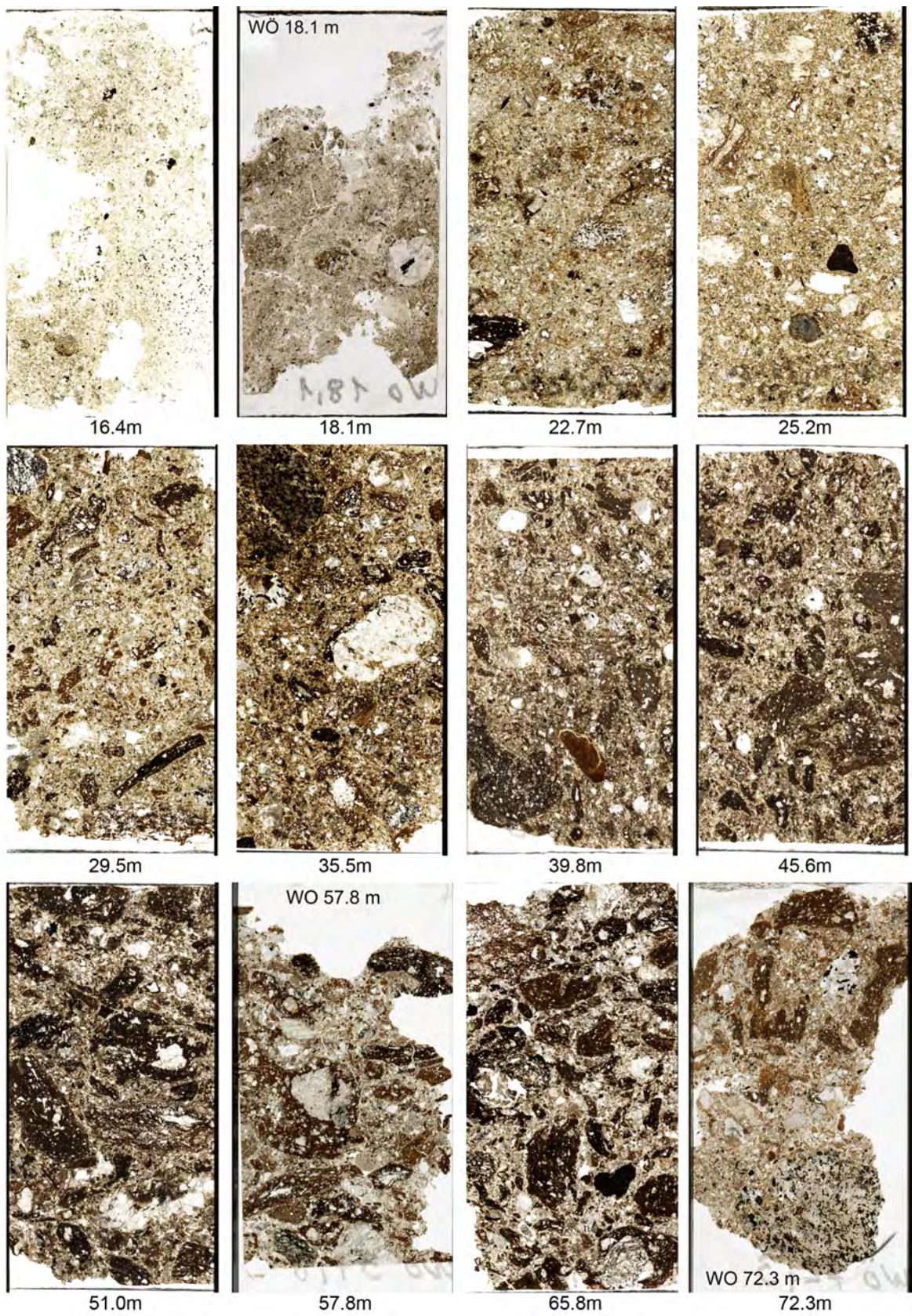


Fig. A.94.: Thin section photographs of Wörnitzostheim (16.4 - 72.3 m)

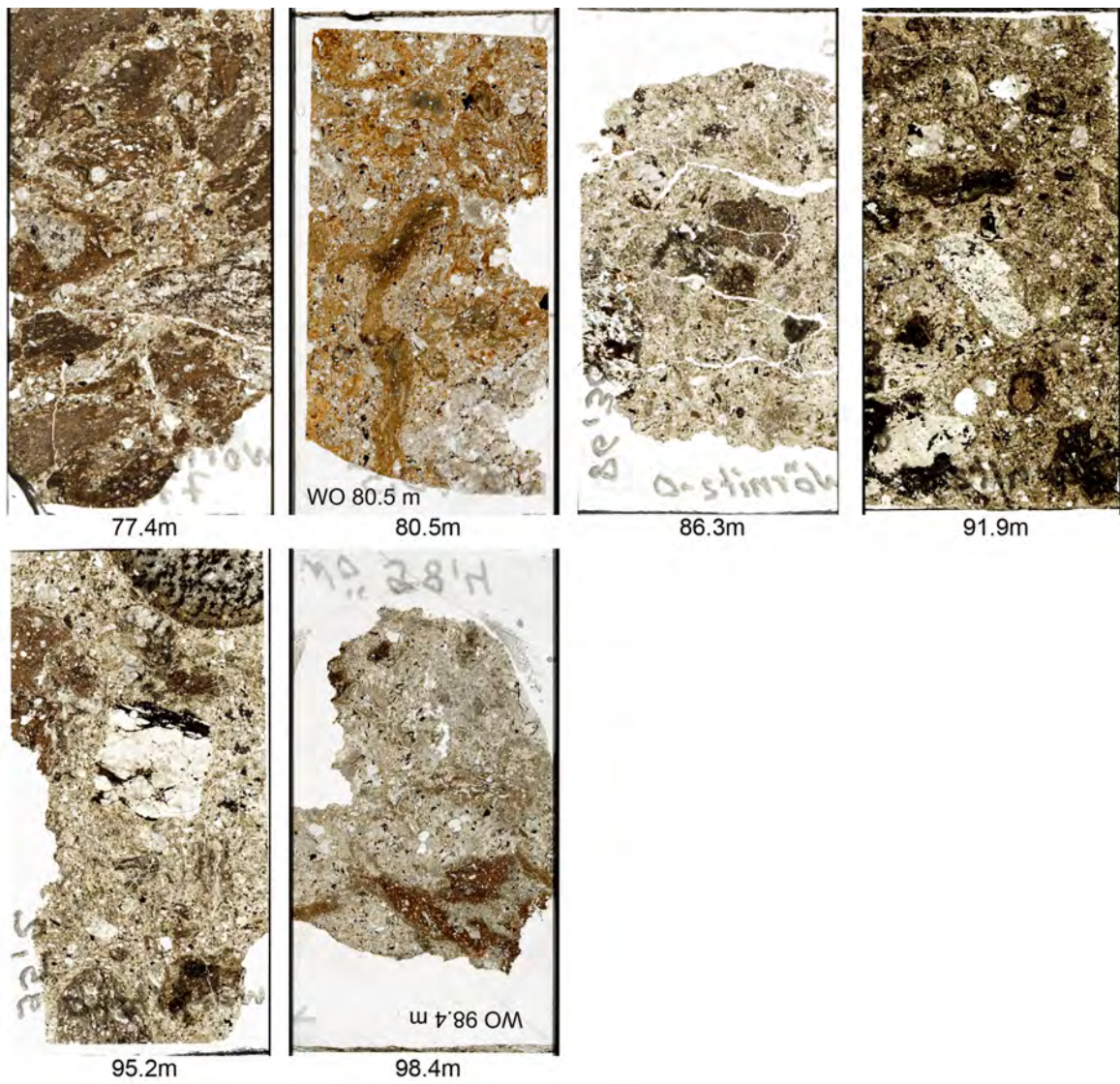


Fig. A.95.: Thin section photographs of Wörnitzostheim (77.4 - 98.4 m)

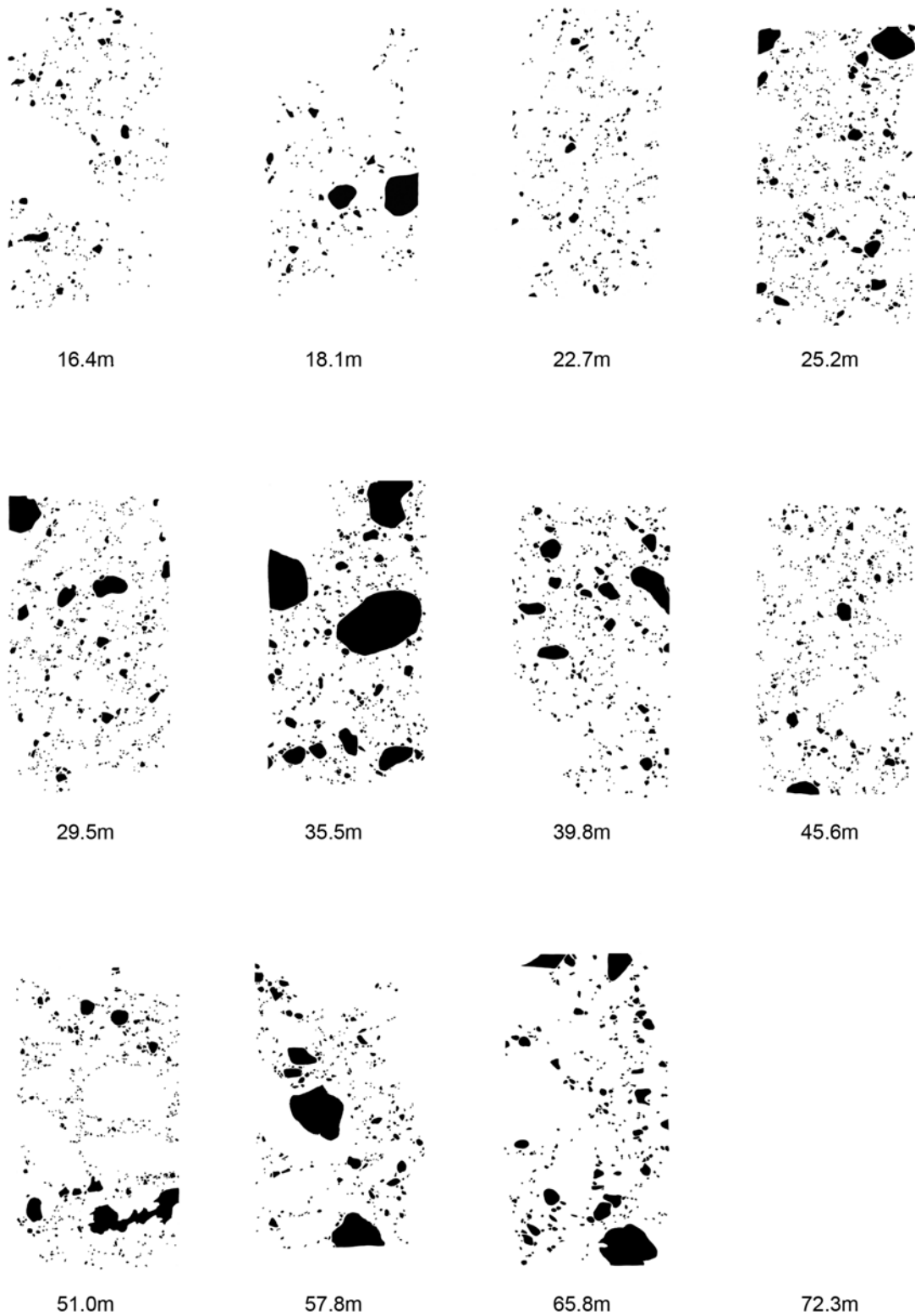


Fig. A.96.: Thin section templates of Wörnitzostheim (lithic clasts 16.4 - 72.3 m)

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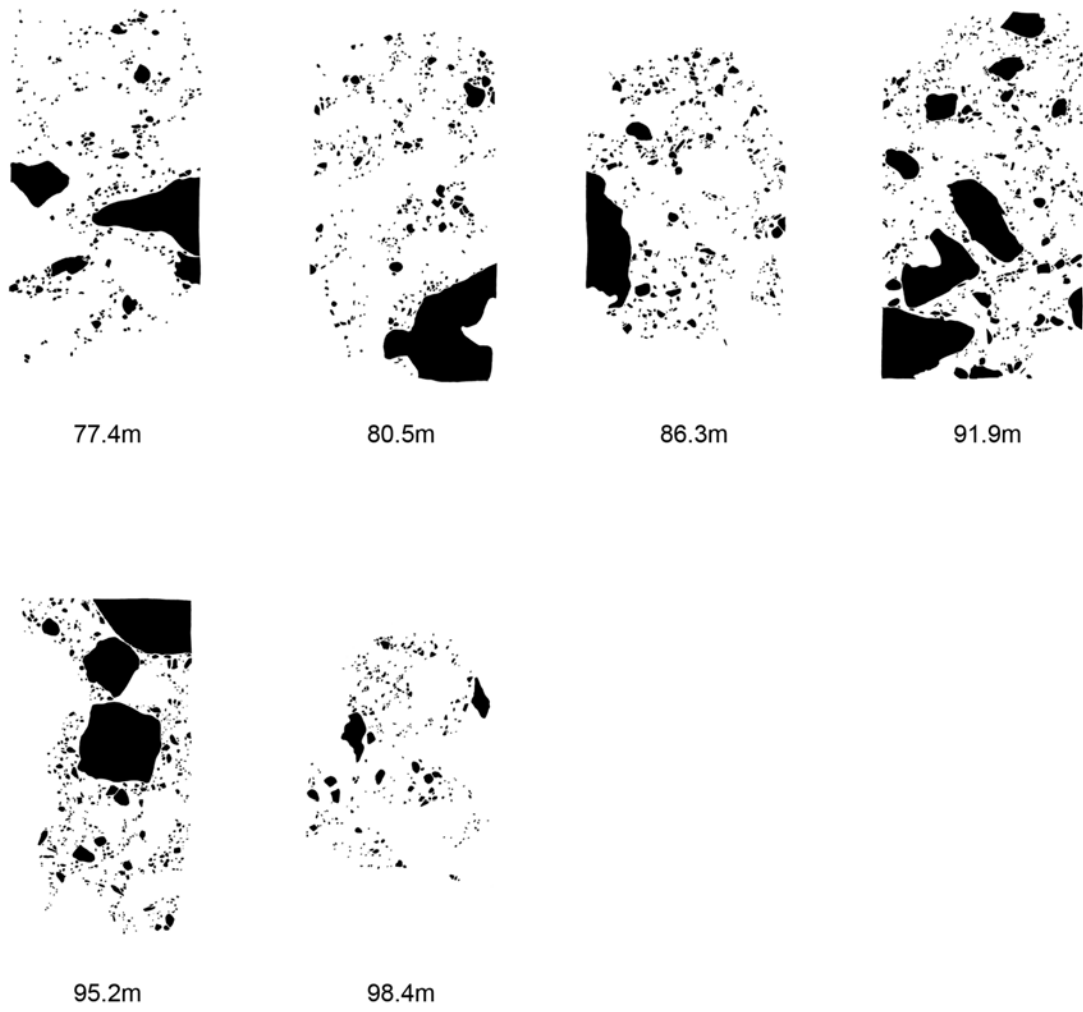


Fig. A.97.: Thin section templates of Wörnitzostheim (lithic clasts 77.4 - 98.4 m)

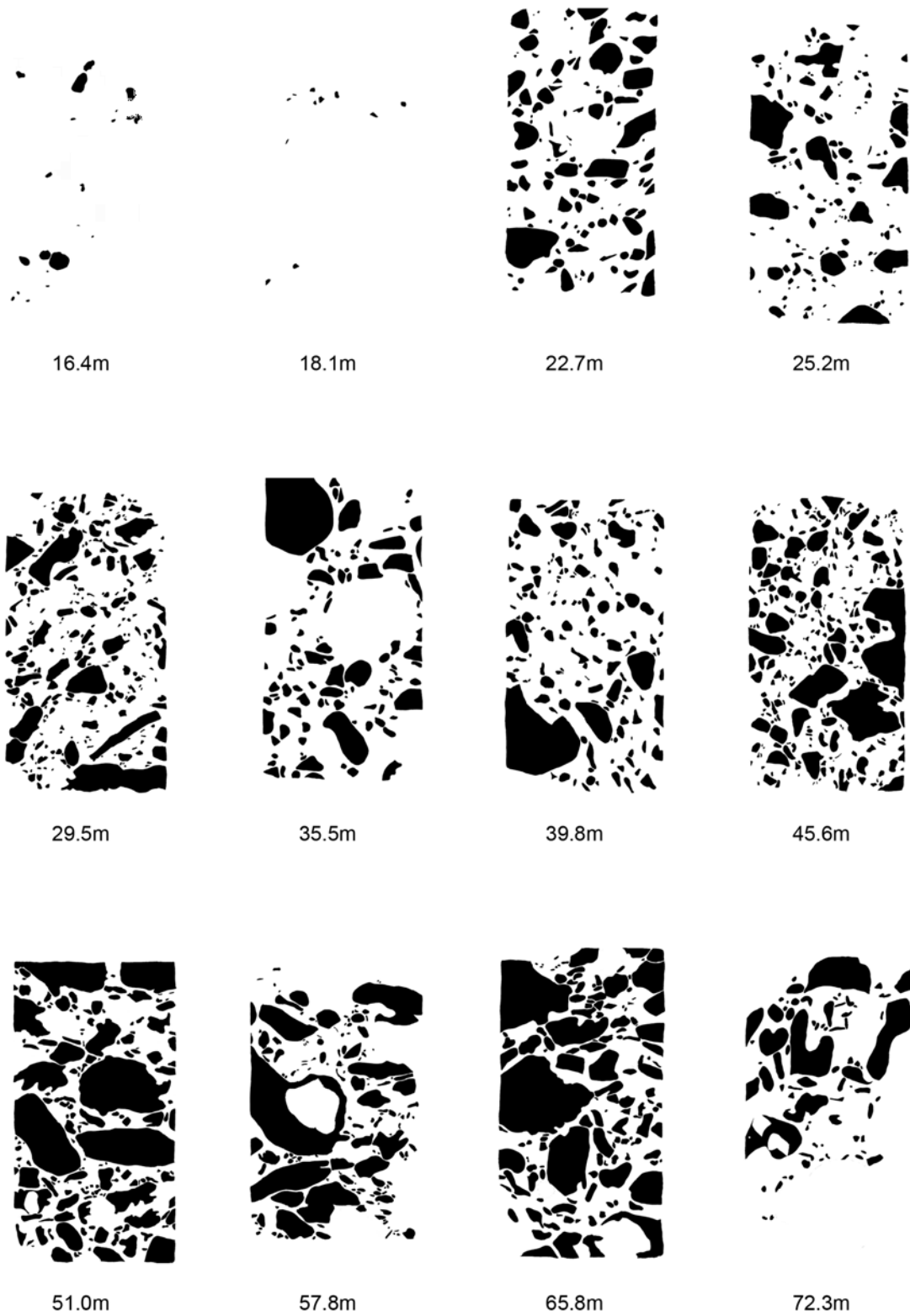


Fig. A.98.: Thin section templates of Wörmitzostheim (melt particles 16.4 - 72.3 m)

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77.4m



80.5m



86.3m



91.9m

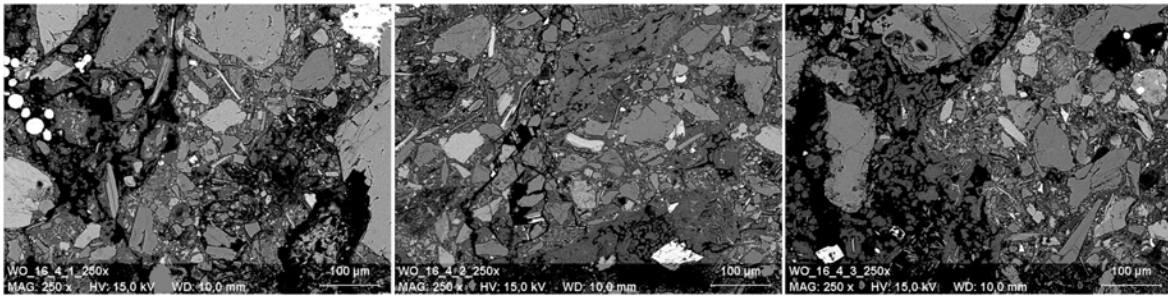


95.2m



98.4m

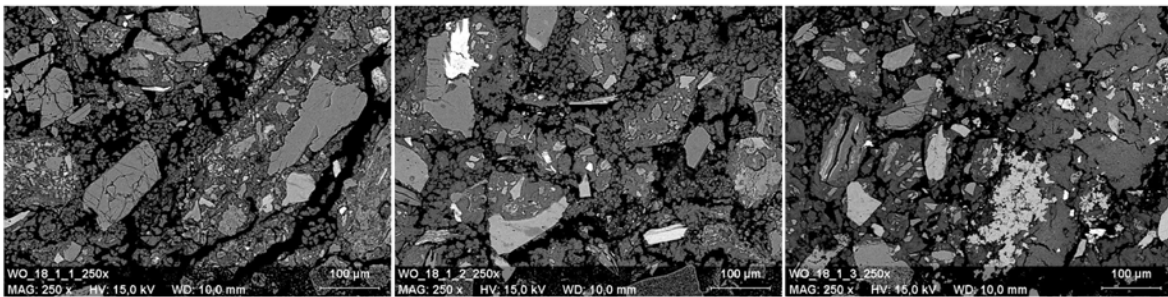
Fig. A.99.: Thin section templates of Wörnitzostheim (melt particles 77.4 - 98.4 m)



16.4m

16.4m

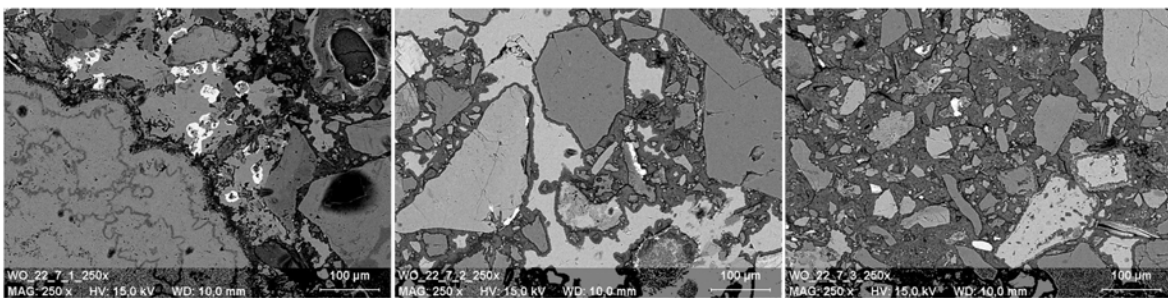
16.4m



18.1m

18.1m

18.1m



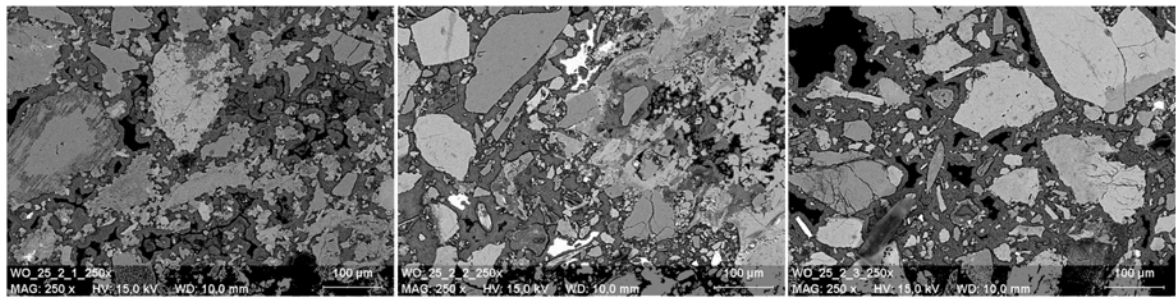
22.7m

22.7m

22.7m

Fig. A.100.: SE pictures of Wörnitzostheim (16.4 - 22.7 m)

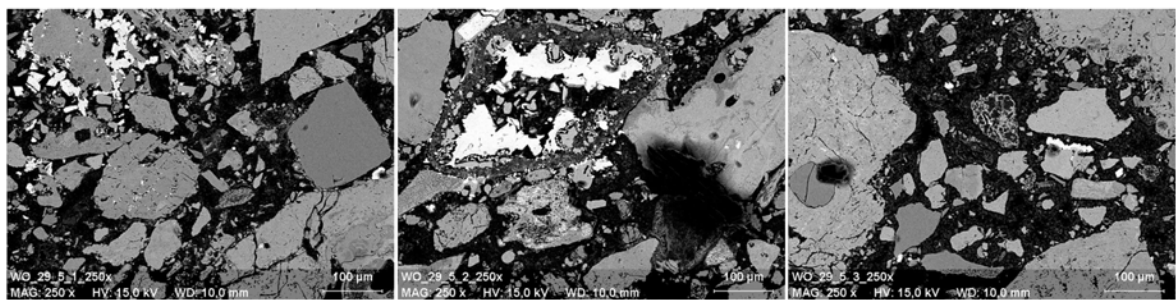
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25.2m

25.2m

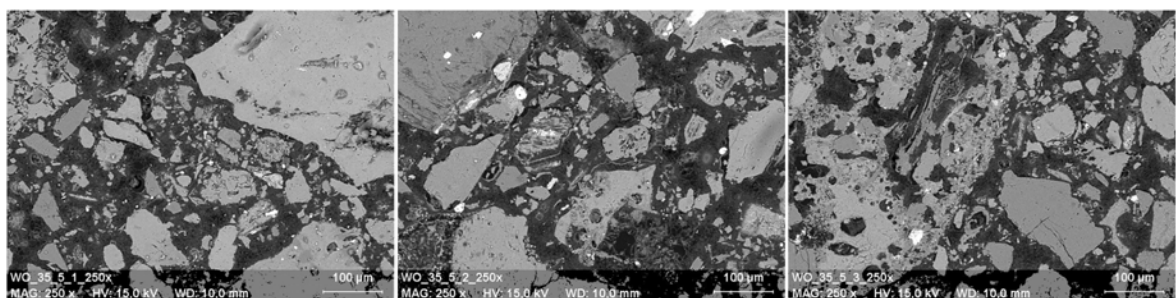
25.2m



29.5m

29.5m

29.5m

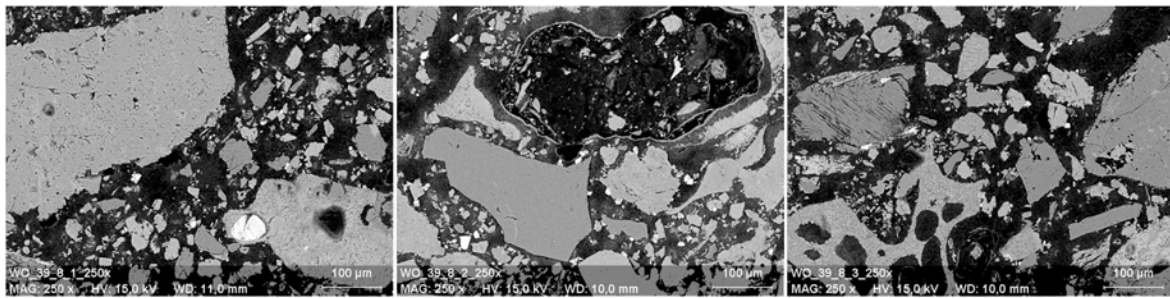


35.5m

35.5m

35.5m

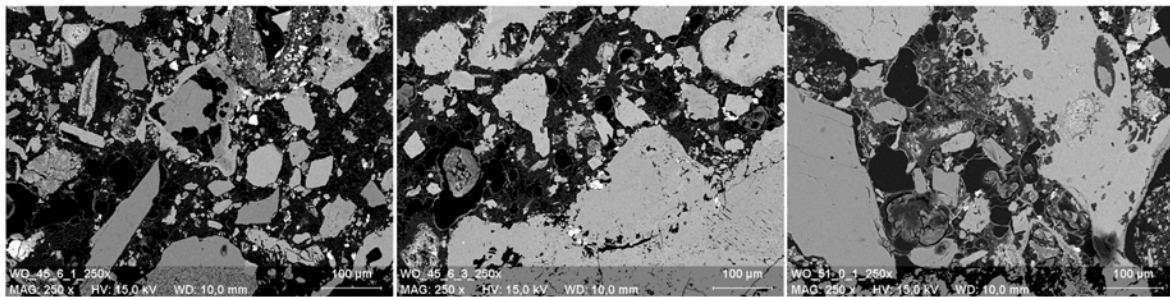
Fig. A.101.: SE pictures of Wörnitzostheim (25.2 - 35.5 m)



39.8m

39.8m

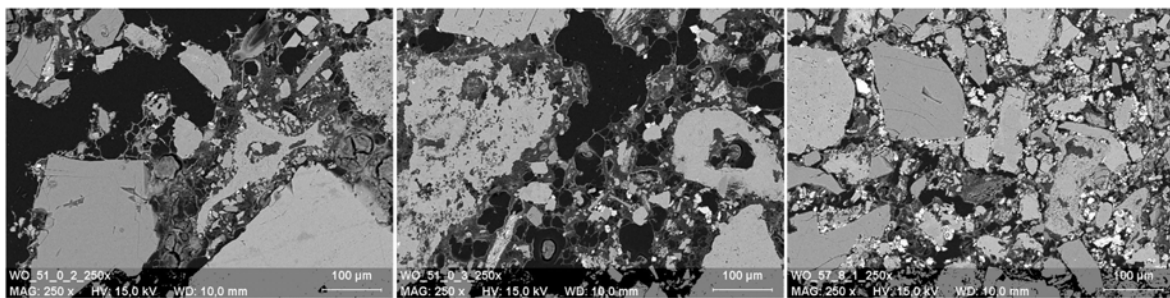
39.8m



45.6m

45.6m

51.0m



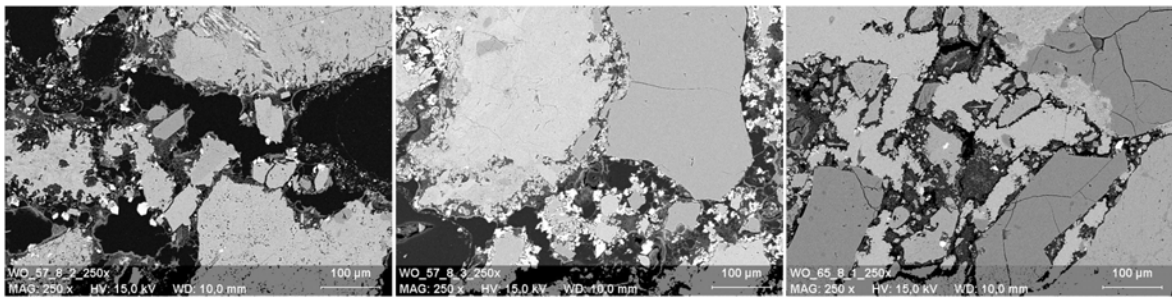
51.0m

51.0m

57.8m

Fig. A.102.: SE pictures of Würnitzostheim (39.8 - 57.8 m)

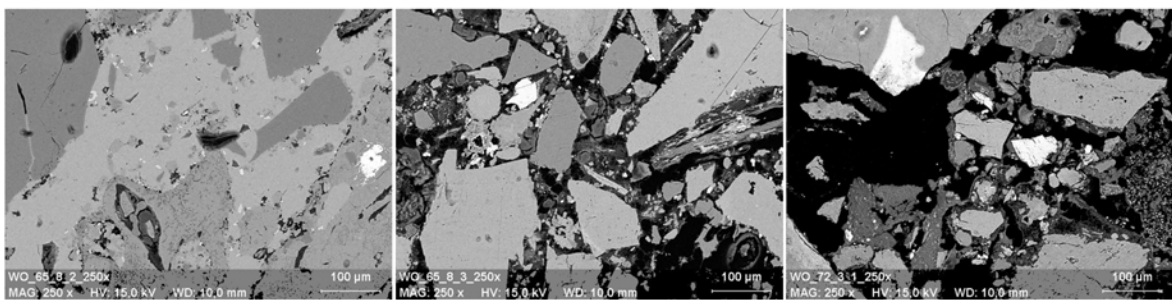
A. Appendix 1



57.8m

57.8m

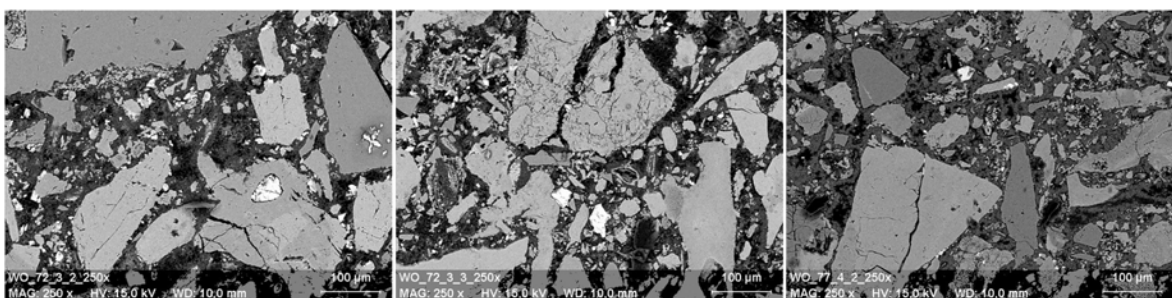
65.8m



65.8m

65.8m

72.3m

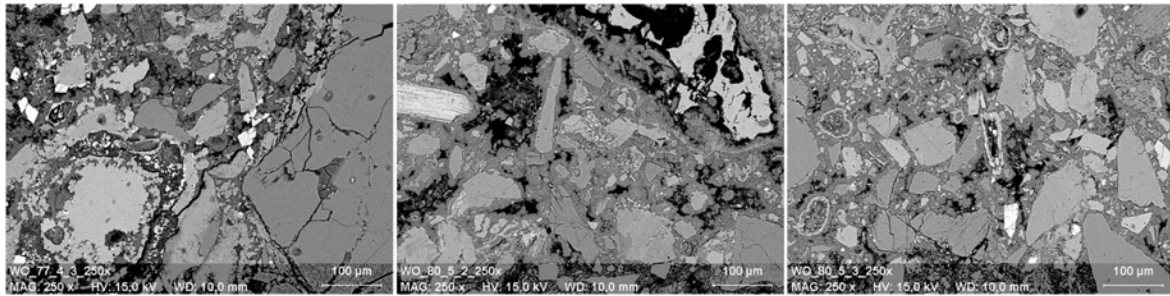


72.3m

72.3m

77.4m

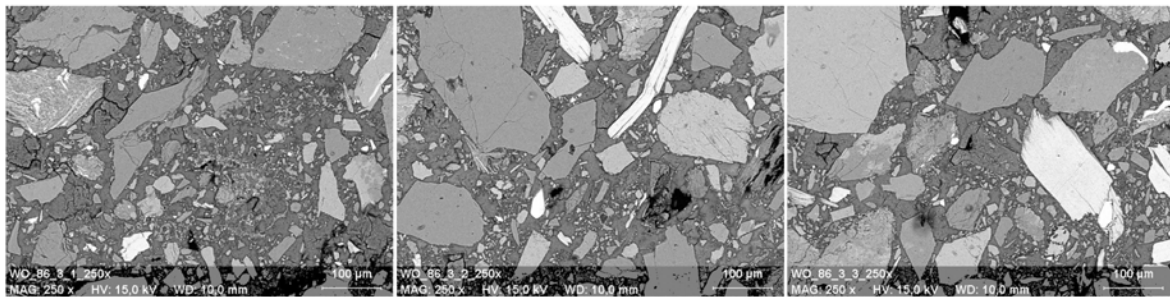
Fig. A.103.: SE pictures of Wörnitzostheim (57.8 - 77.4 m)



77.4m

80.5m

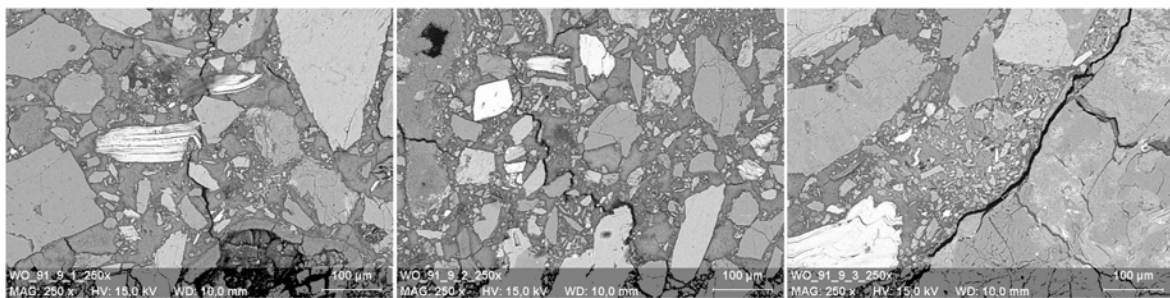
80.5m



86.3m

86.3m

86.3m



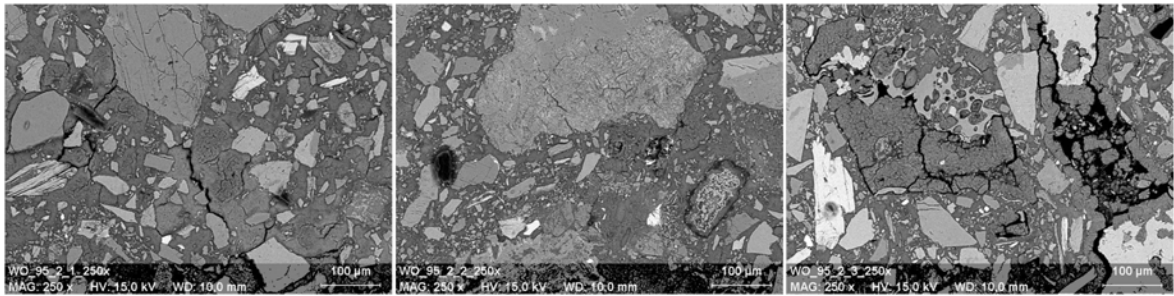
91.9m

91.9m

91.9m

Fig. A.104.: SE pictures of Wörnitzostheim (77.4 - 91.9 m)

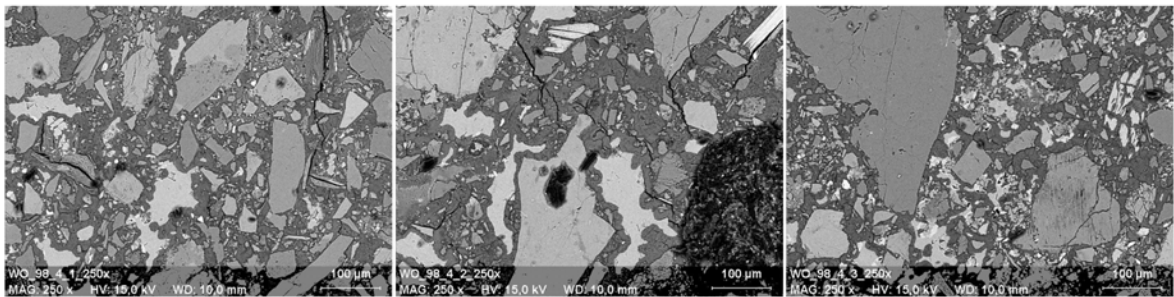
A. Appendix 1



95.2m

95.2m

95.2m



98.4m

98.4m

98.4m

Fig. A.105.: SE pictures of Wörnitzostheim (95.2 - 98.4 m)

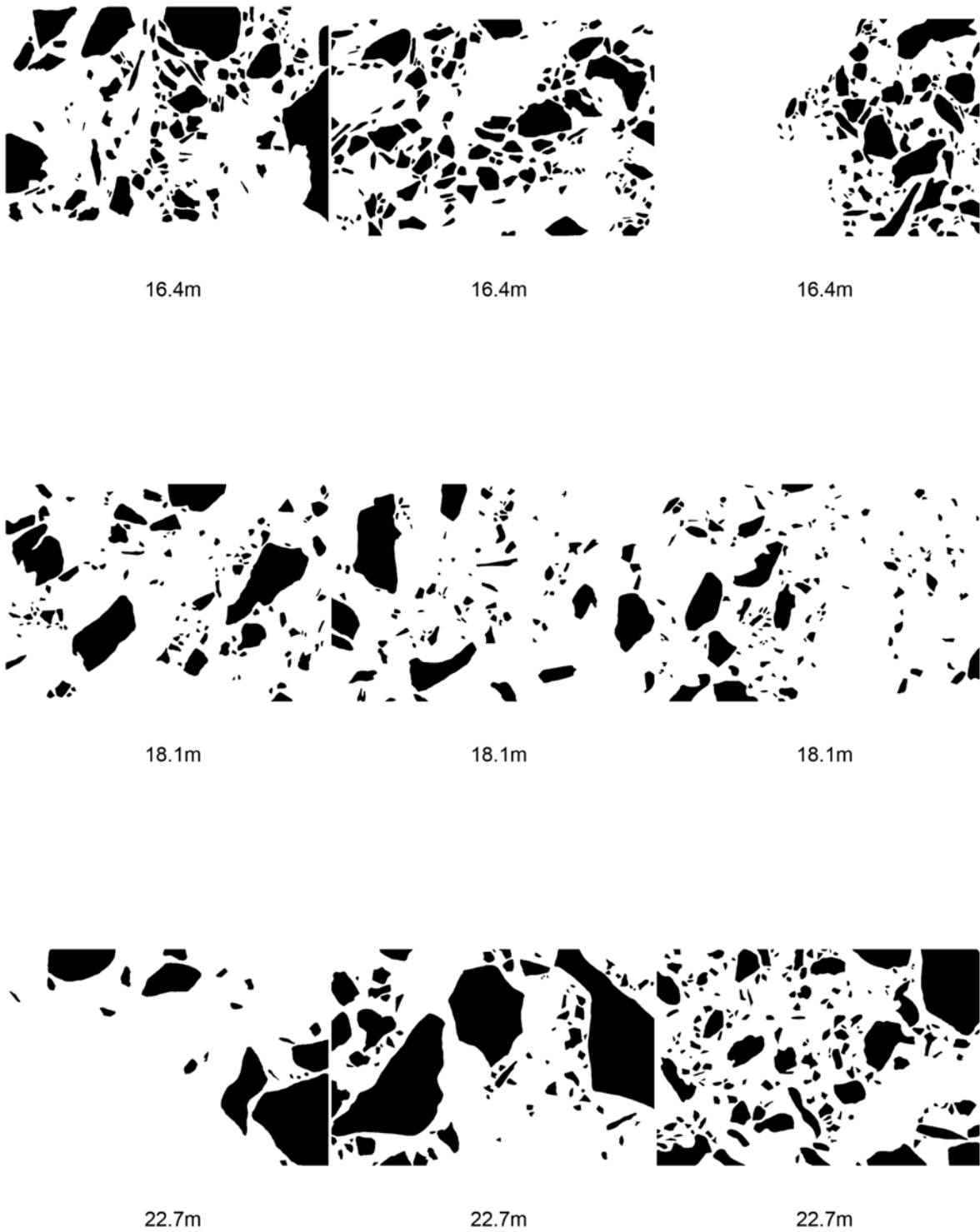


Fig. A.106.: SE templates of Wörnitzostheim (lithic clasts 16.4 - 22.7 m)

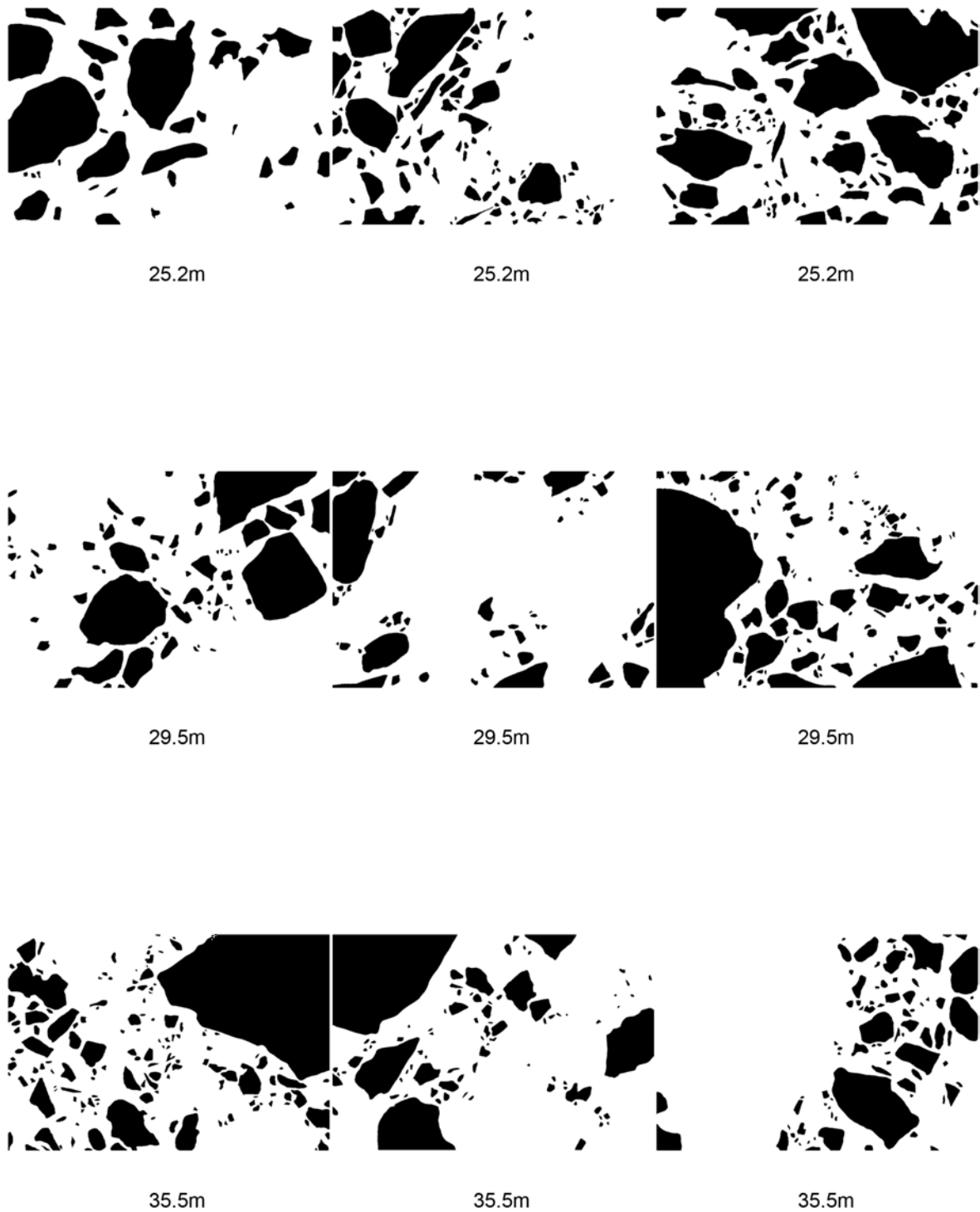


Fig. A.107.: SE templates of Wörnitzostheim (lithic clasts 25.2 - 35.5 m)

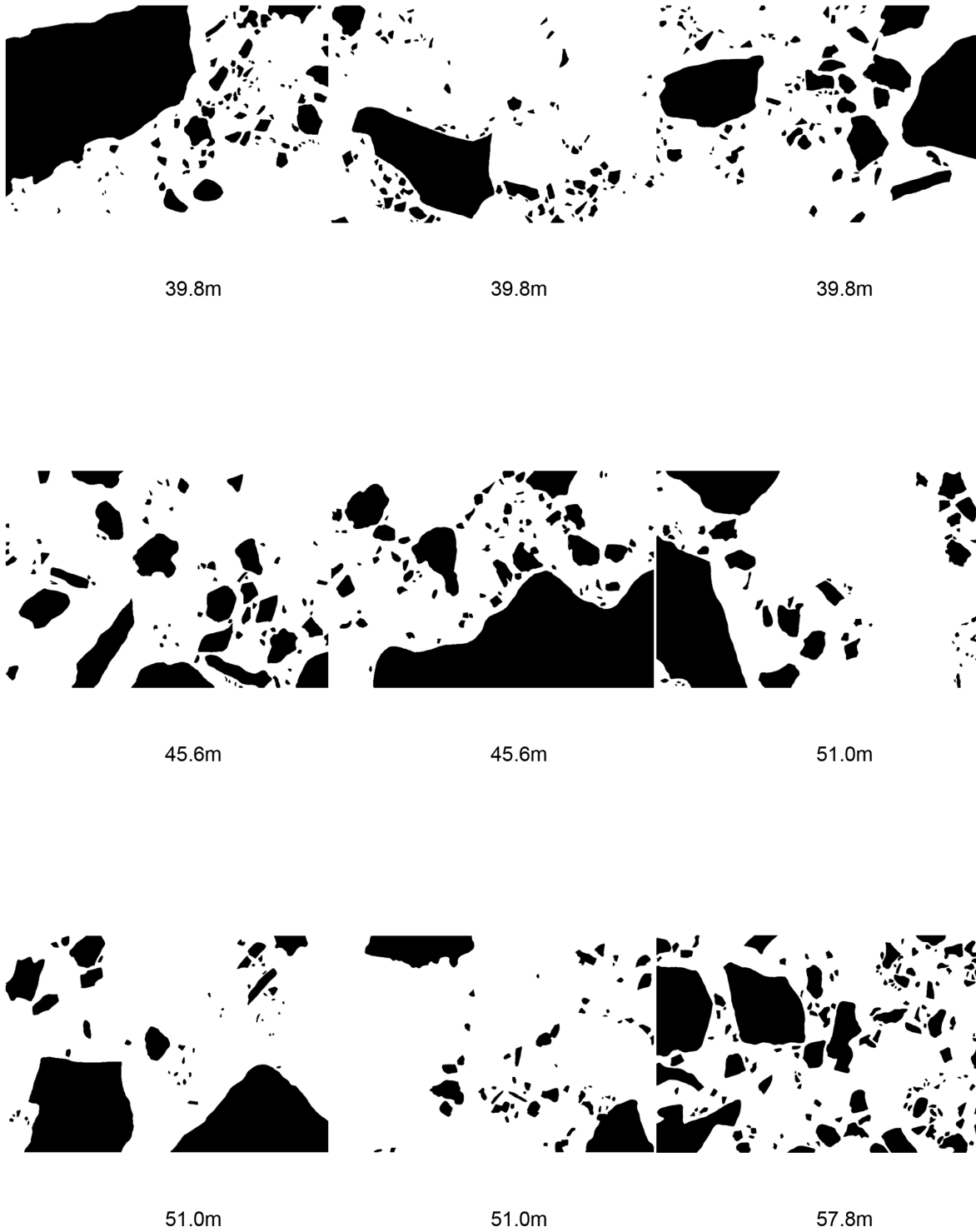


Fig. A.108.: SE templates of Würnitzostheim (lithic clasts 39.8 - 57.8 m)

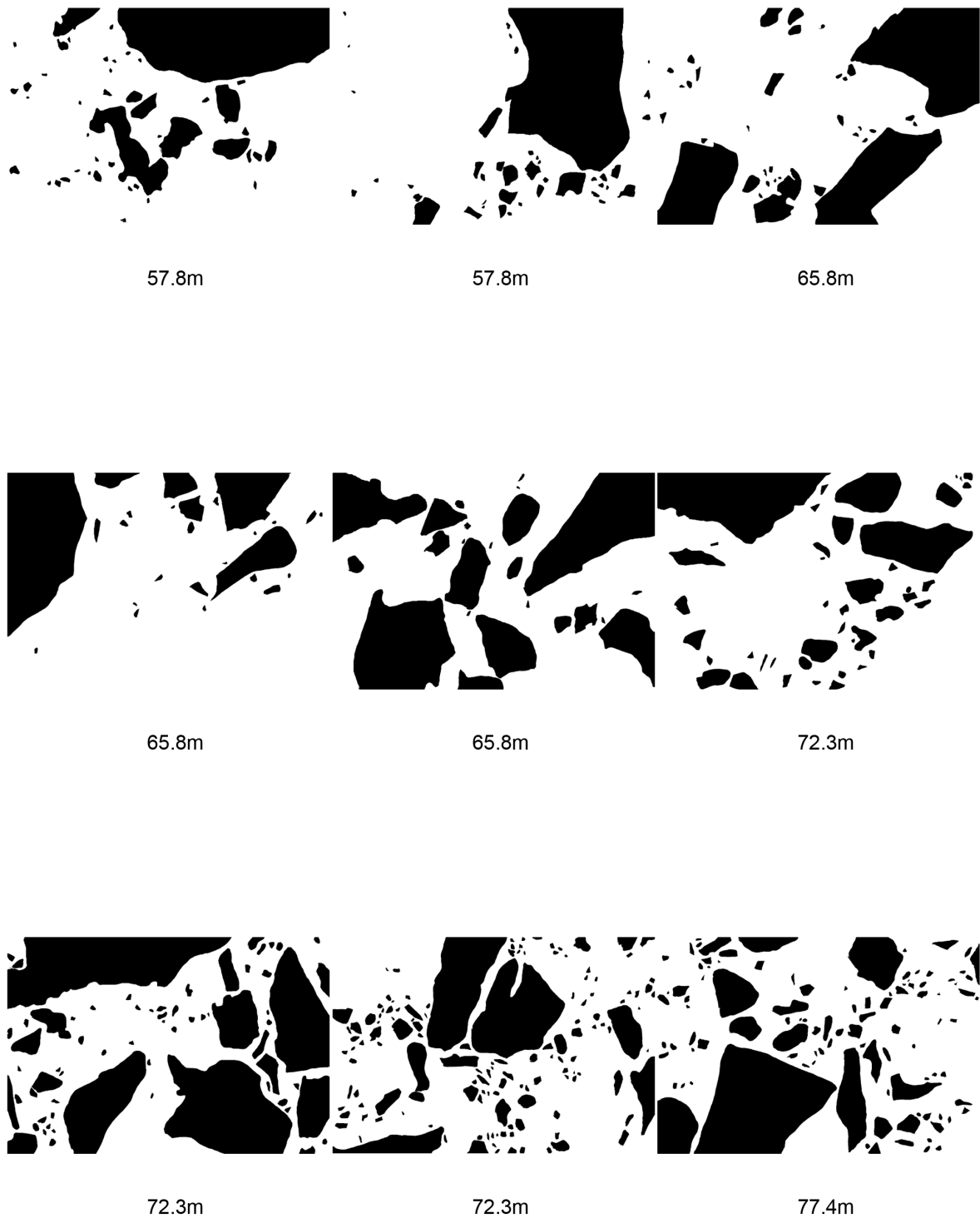


Fig. A.109.: SE templates of Wörnitzostheim (lithic clasts 57.8 - 77.4 m)

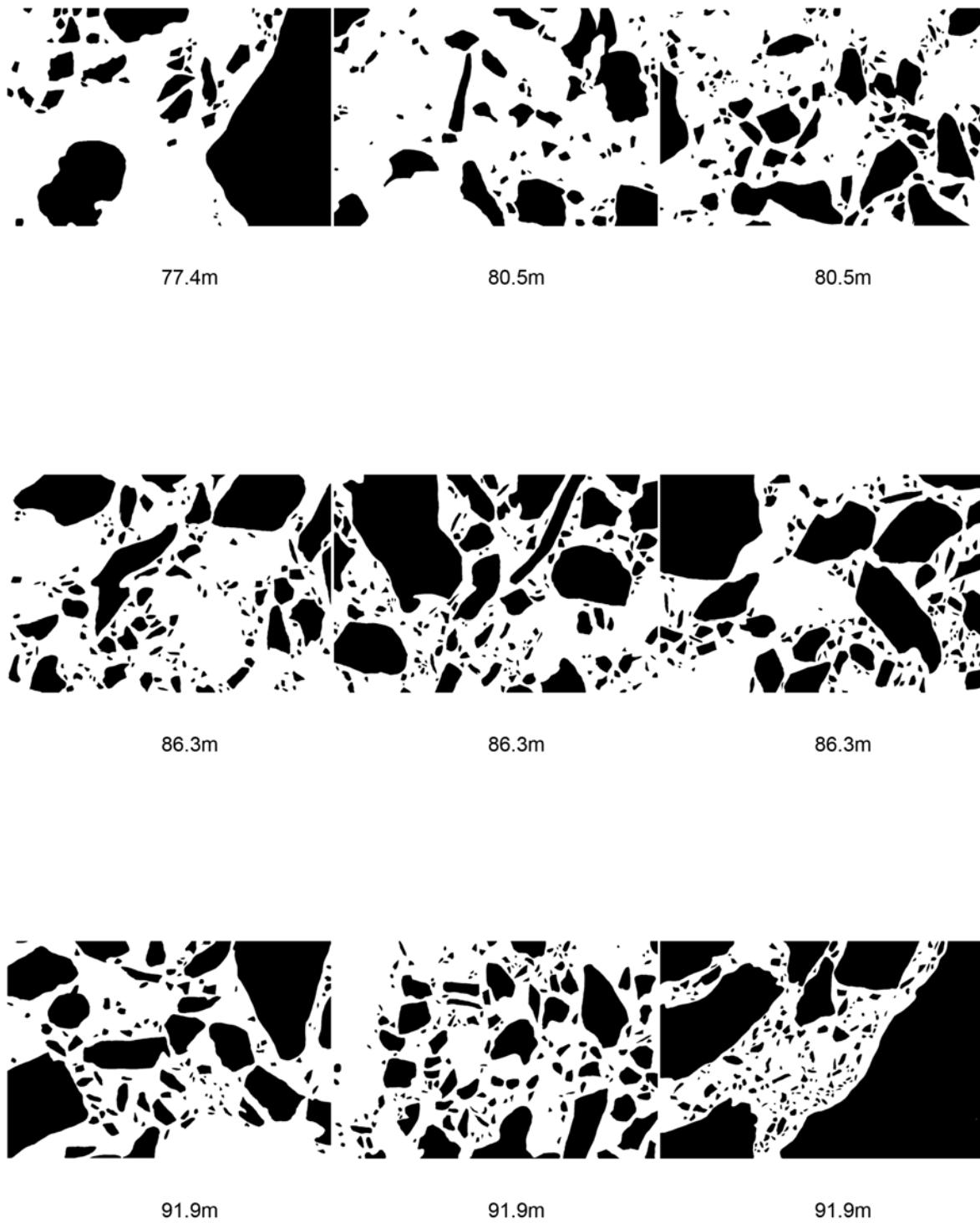


Fig. A.110.: SE templates of Wörnitzostheim (lithic clasts 77.4 - 91.9 m)

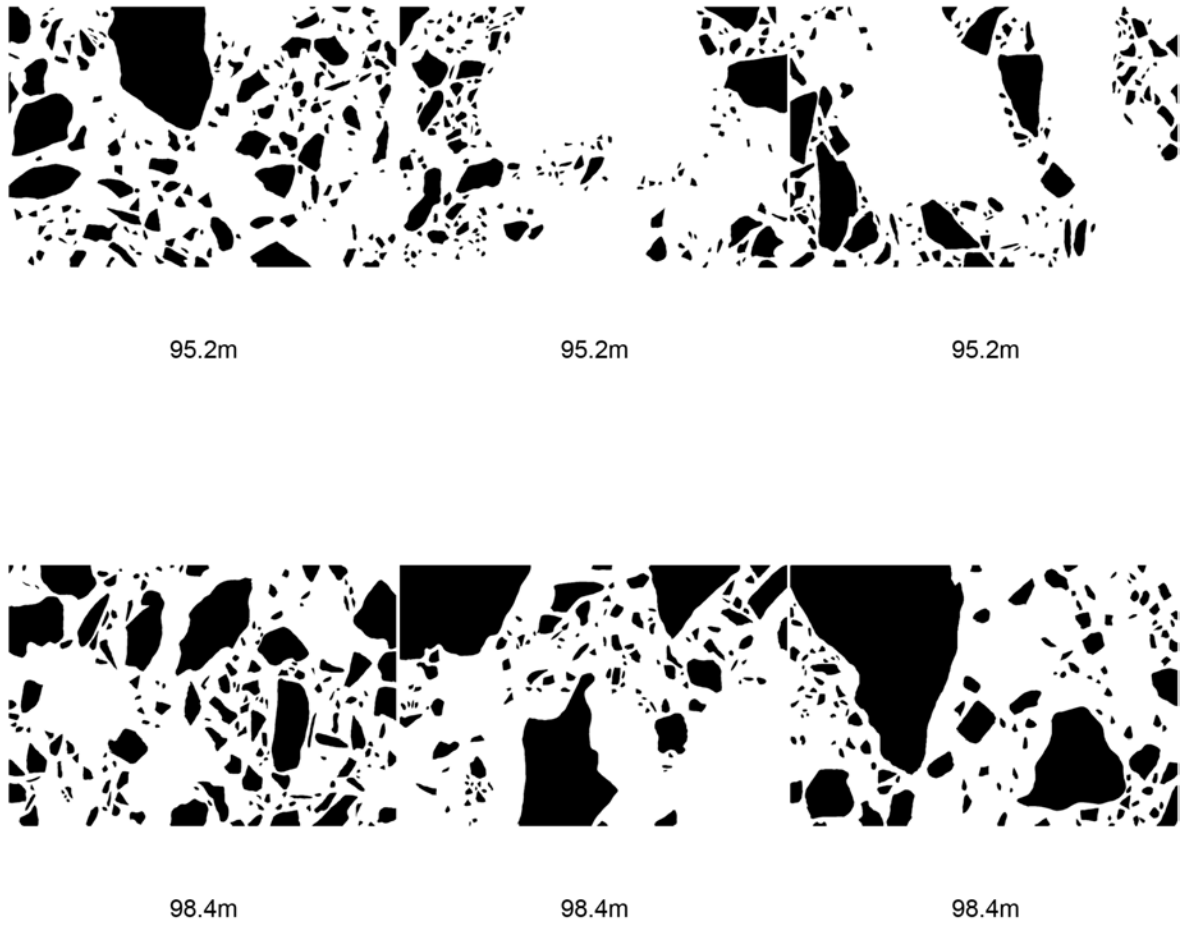


Fig. A.111.: SE templates of Wörnitzostheim (lithic clasts 95.2 - 98.4 m)

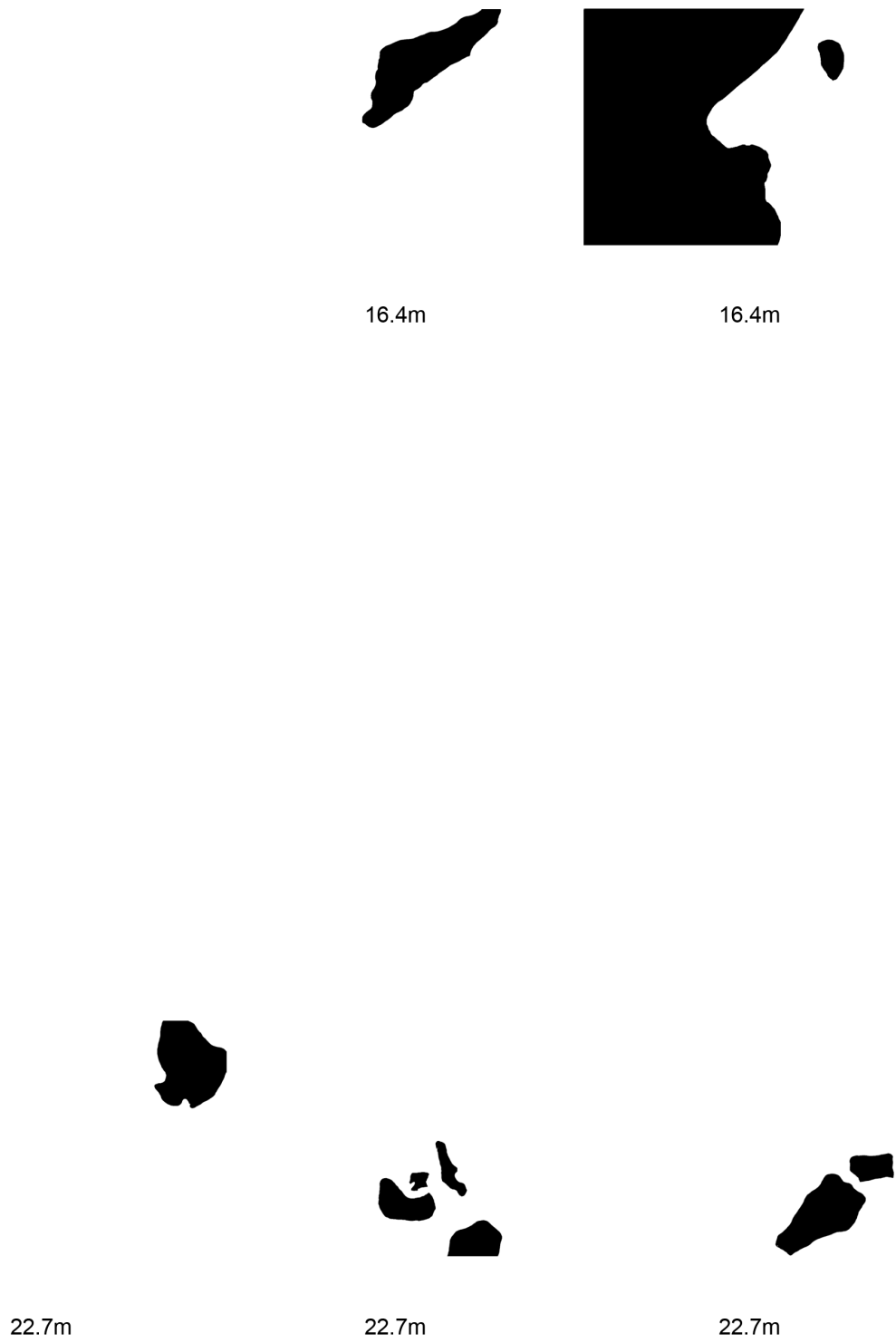


Fig. A.112.: SE templates of Wörnitzostheim (melt particles 16.4 - 22.7 m)



Fig. A.113.: SE templates of Wörnitzostheim (melt particles 25.2 - 35.5 m)



39.8m

39.8m

39.8m



45.6m

45.6m

51.0m



51.0m

51.0m

57.8m

Fig. A.114.: SE templates of Wörnitzostheim (melt particles 39.8 - 57.8 m)

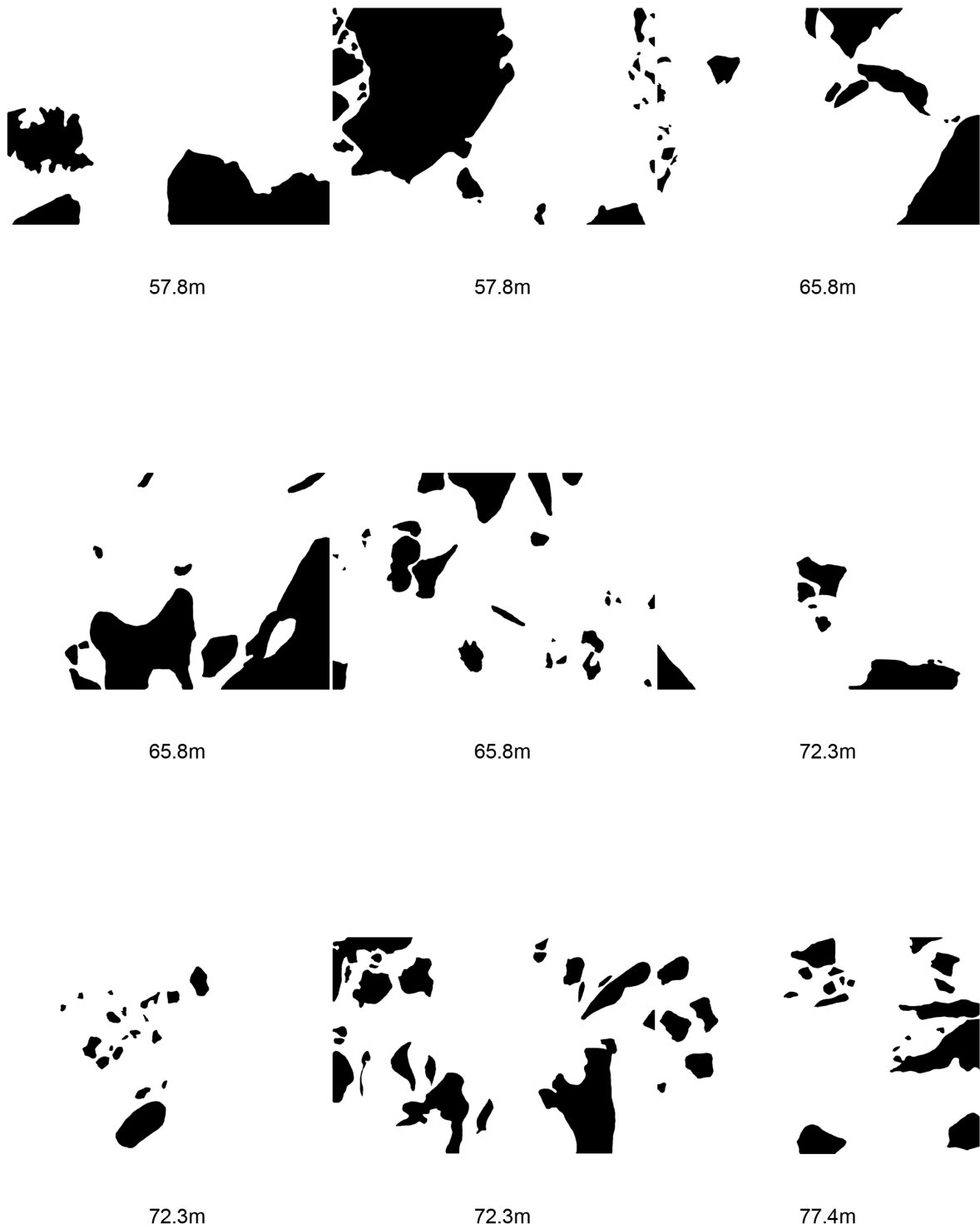


Fig. A.115.: SE templates of Wörnitzostheim (melt particles 57.8 - 77.4 m)

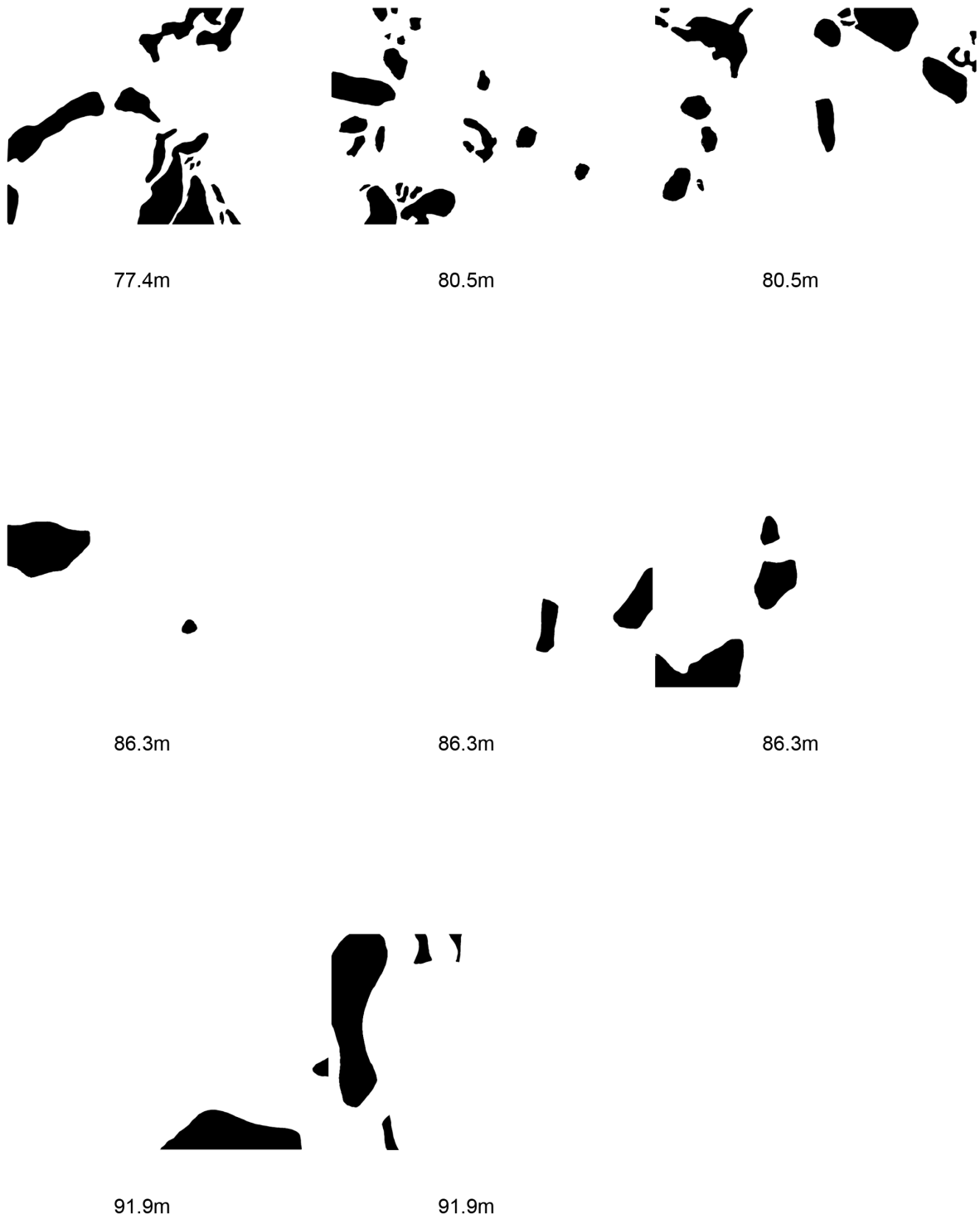


Fig. A.116.: SE templates of Wörnitzostheim (melt particles 77.4 - 91.9 m)

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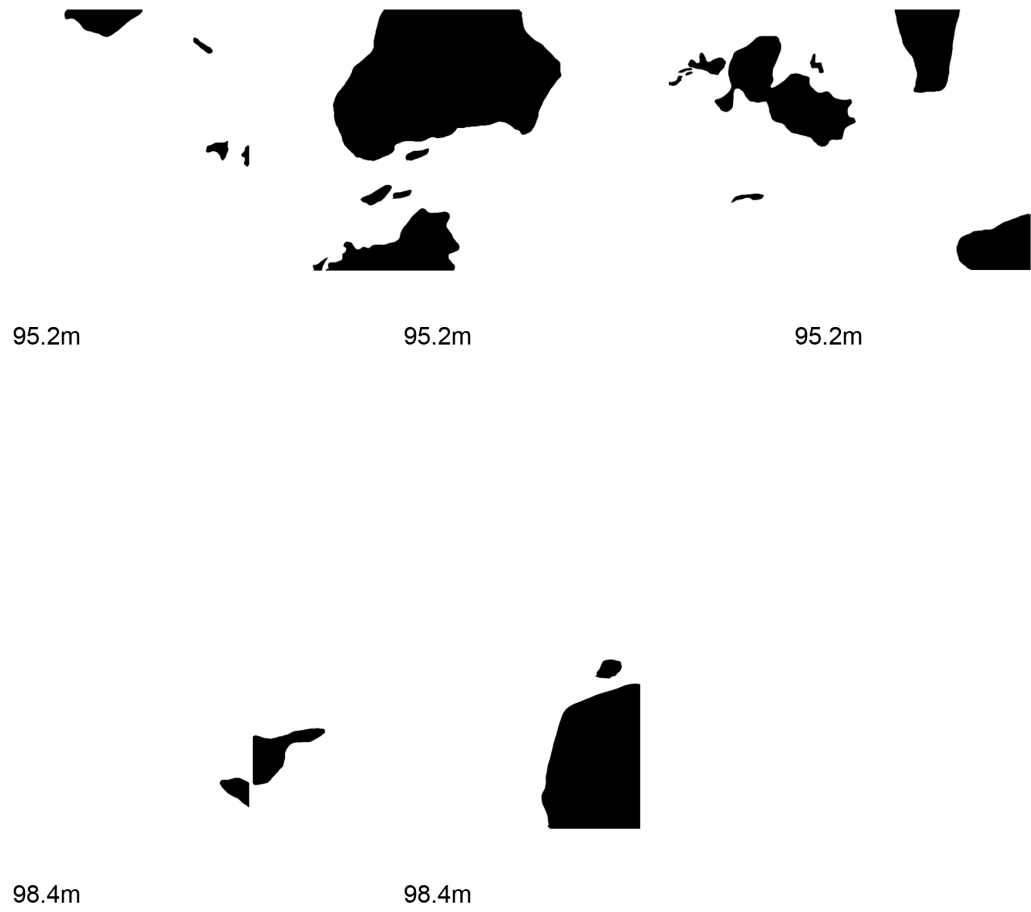


Fig. A.117.: SE templates of Wörnitzostheim (melt particles 95.2 - 98.4 m)

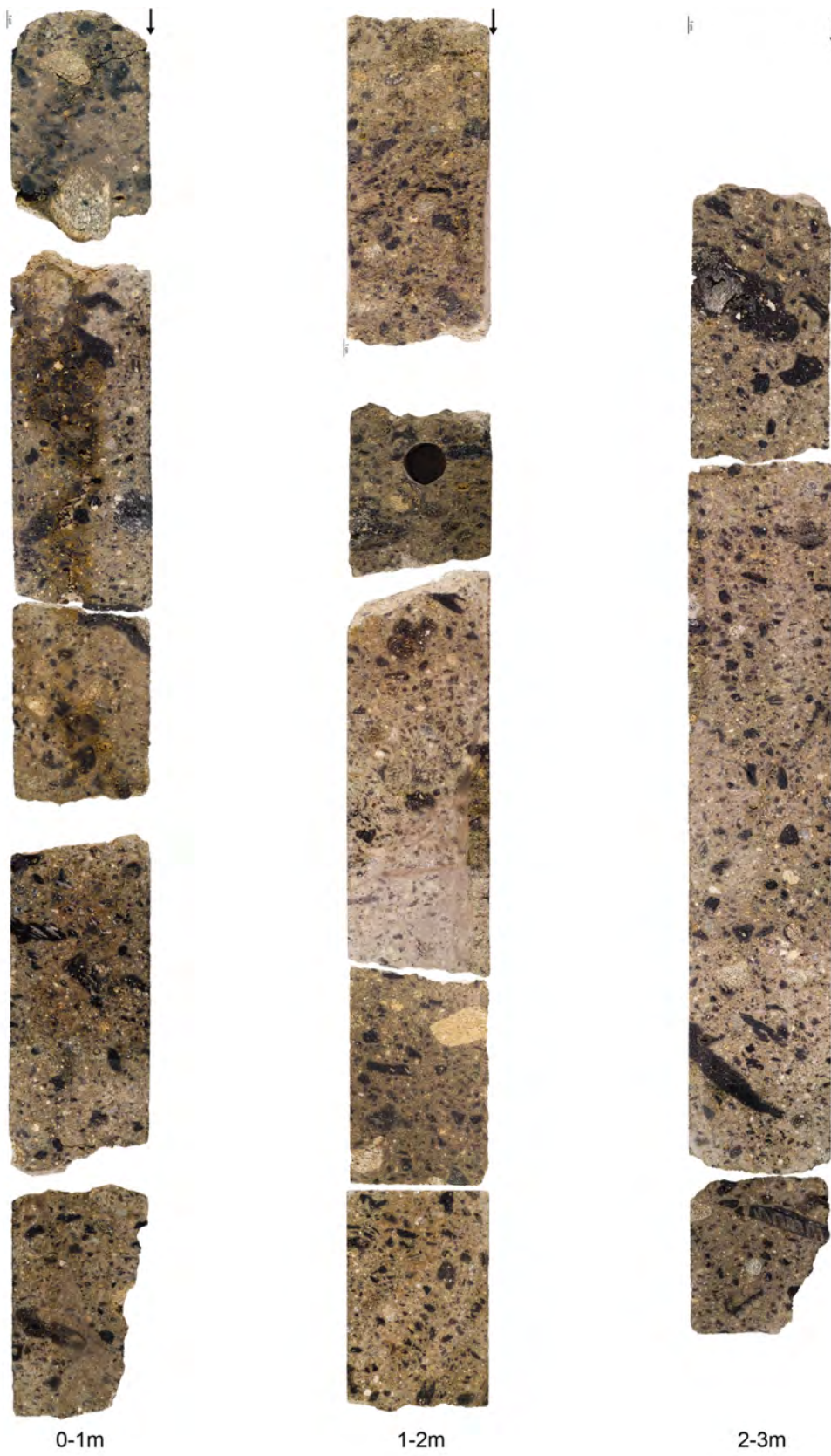


Fig. A.118.: Half core photographs of Otting (0 - 3 m)

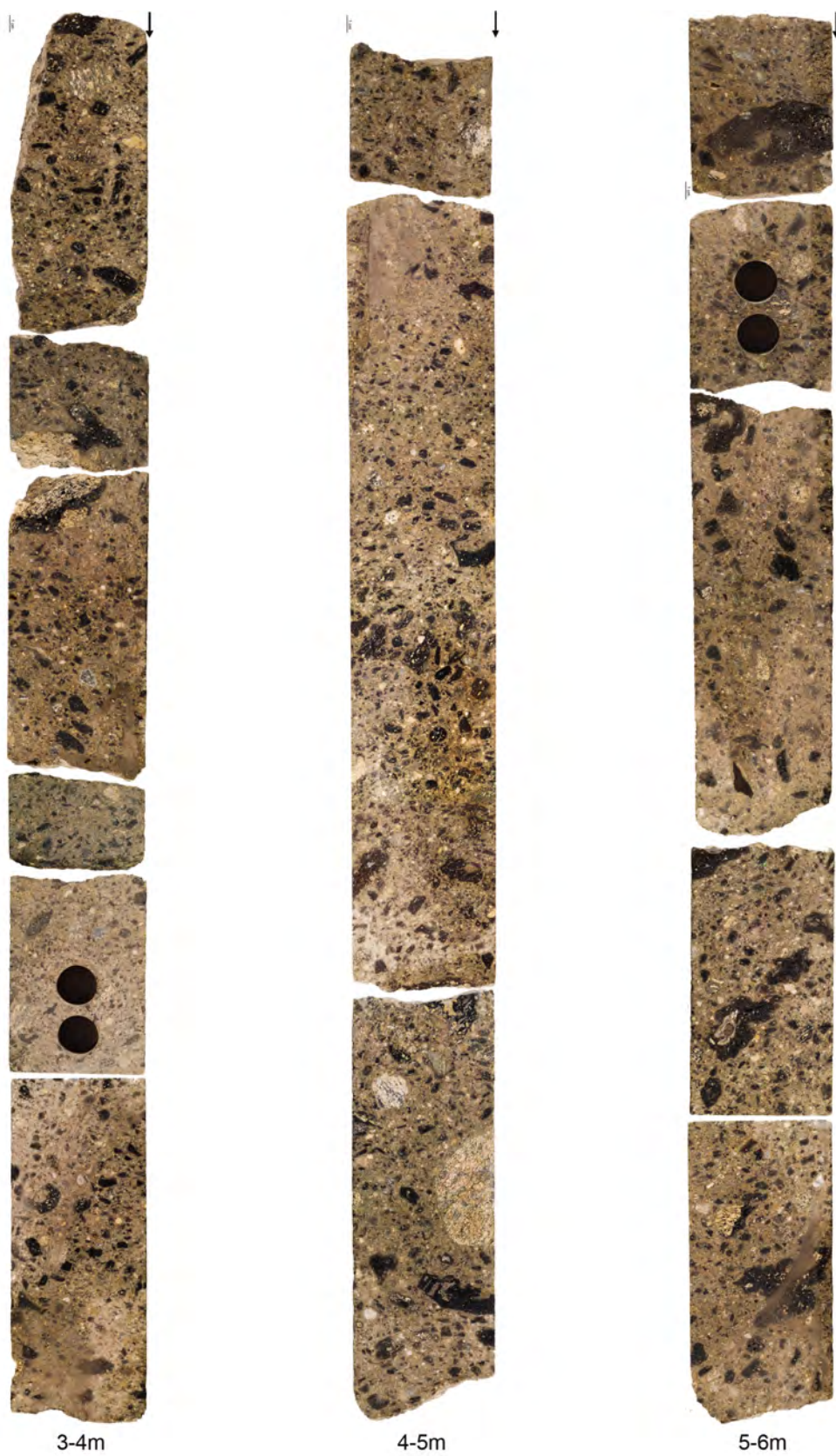


Fig. A.119.: Half core photographs of Otting (3 - 6 m)



Fig. A.120.: Half core photographs of Otting (6 - 9 m)

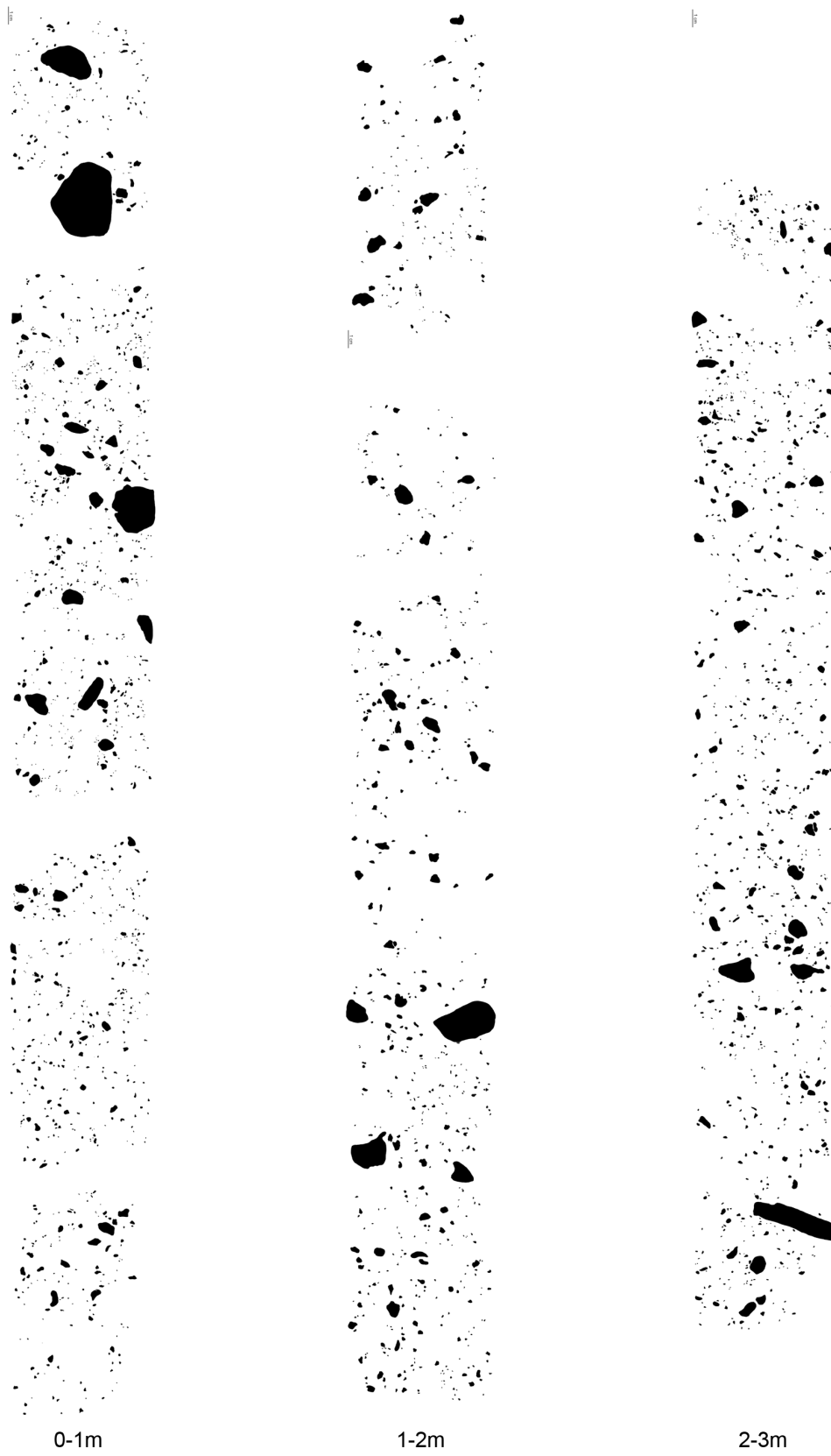


Fig. A.121.: Half core templates of Otting (lithic clasts 0 - 3 m)

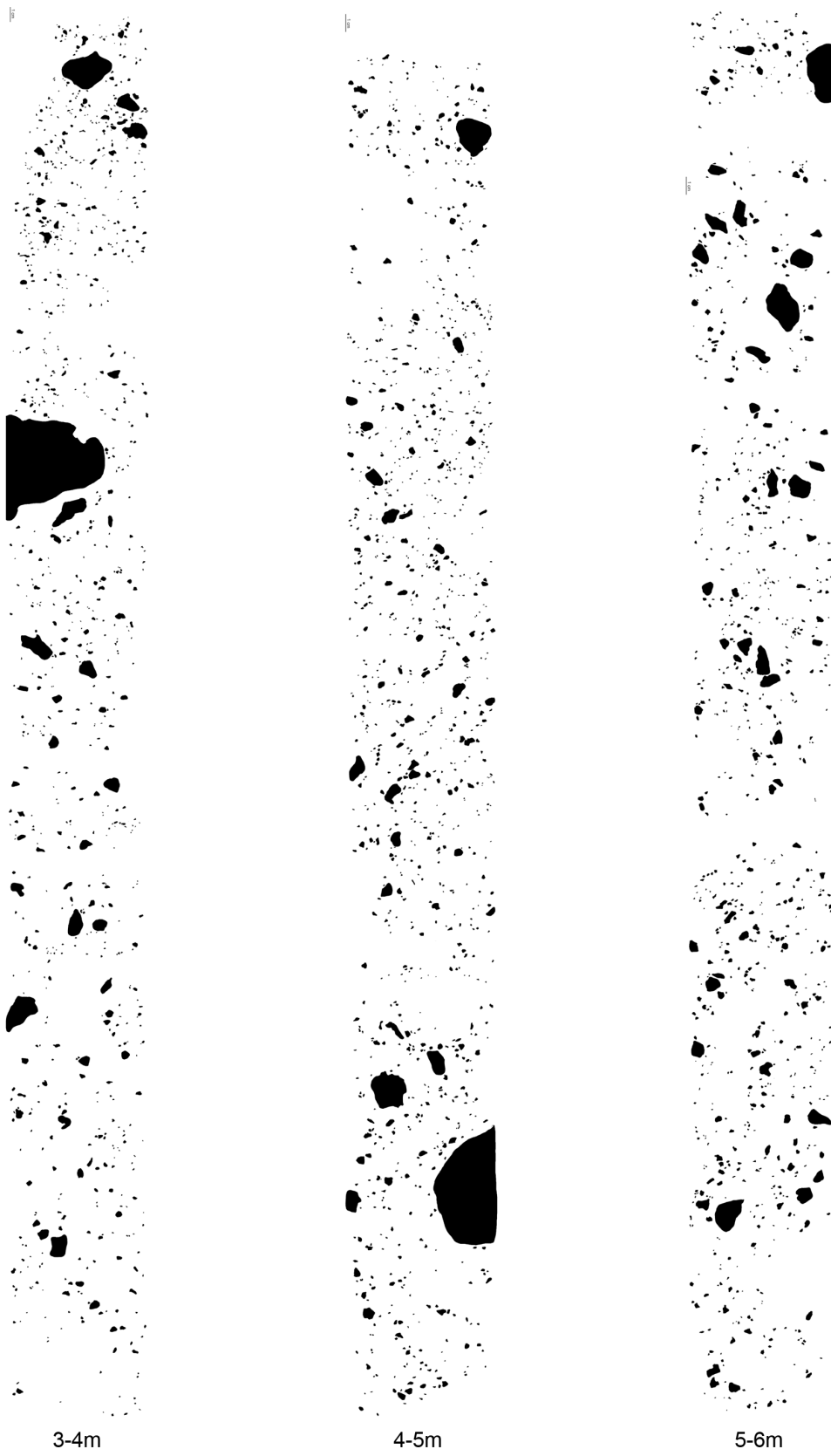


Fig. A.122.: Half core templates of Otting (lithic clasts 3 - 6 m)



Fig. A.123.: Half core templates of Otting (lithic clasts 6 - 9 m)

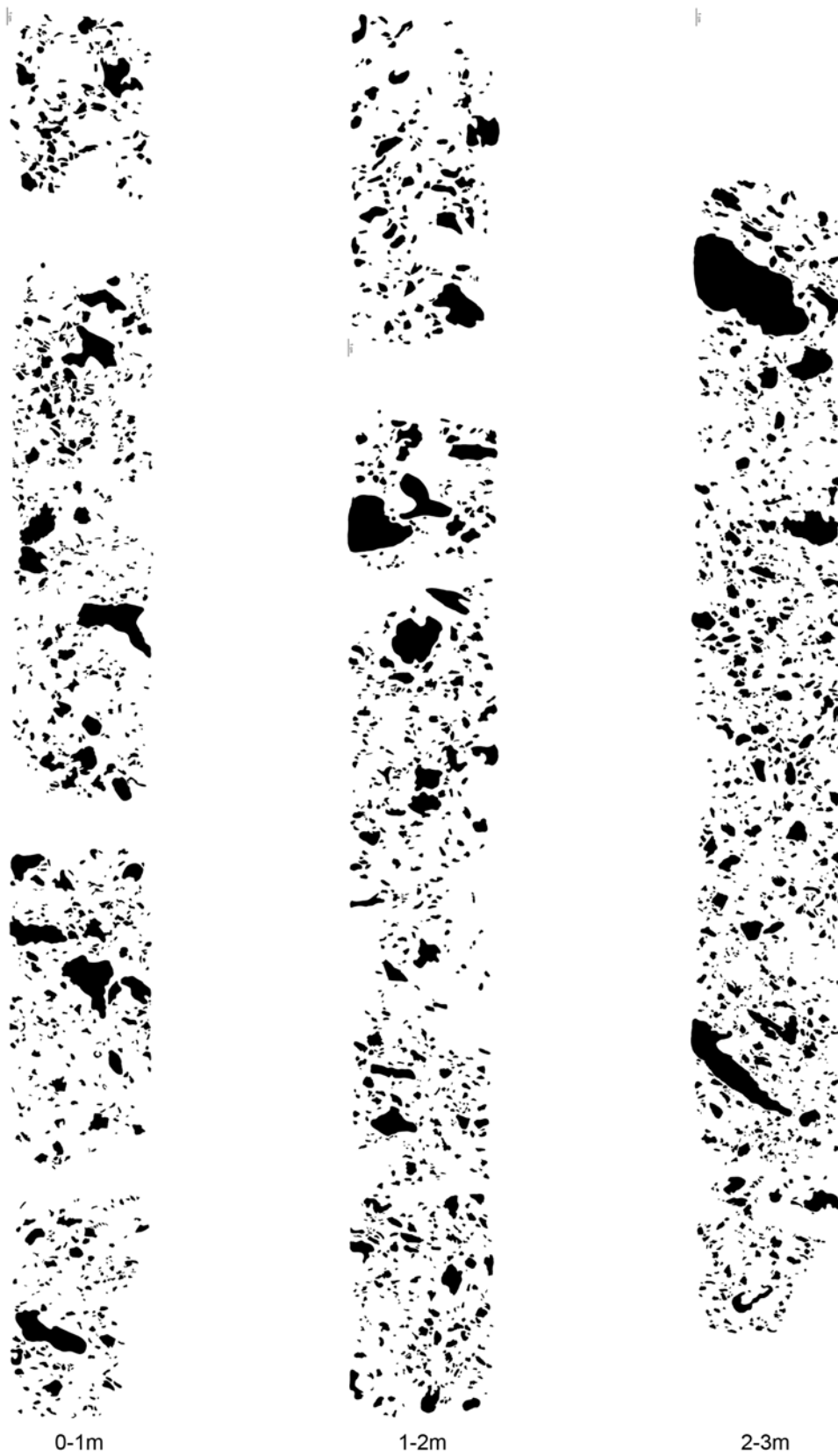


Fig. A.124.: Half core templates of Otting (melt particles 0 - 3 m)

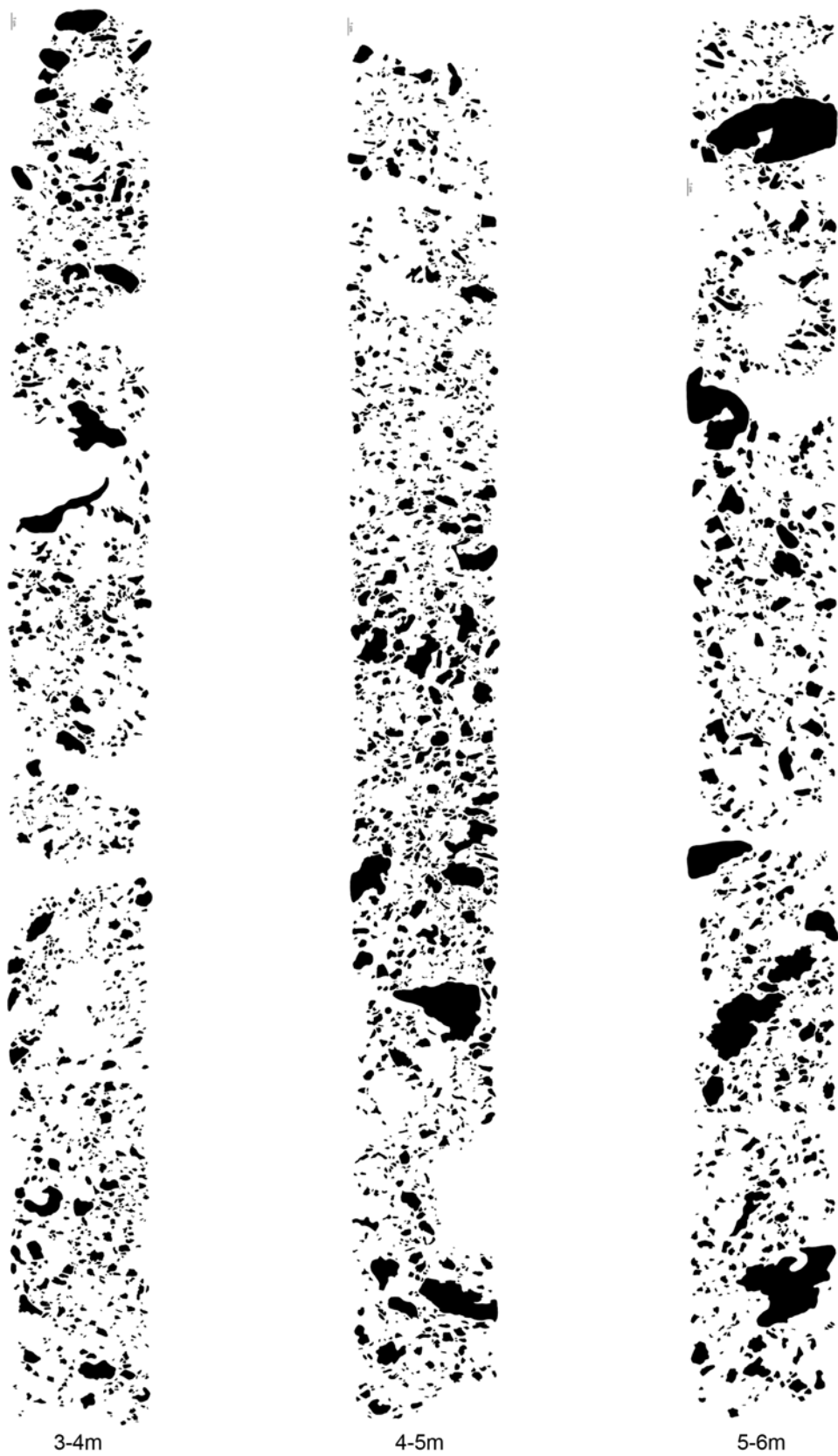


Fig. A.125.: Half core templates of Otting (melt particles 3 - 6 m)

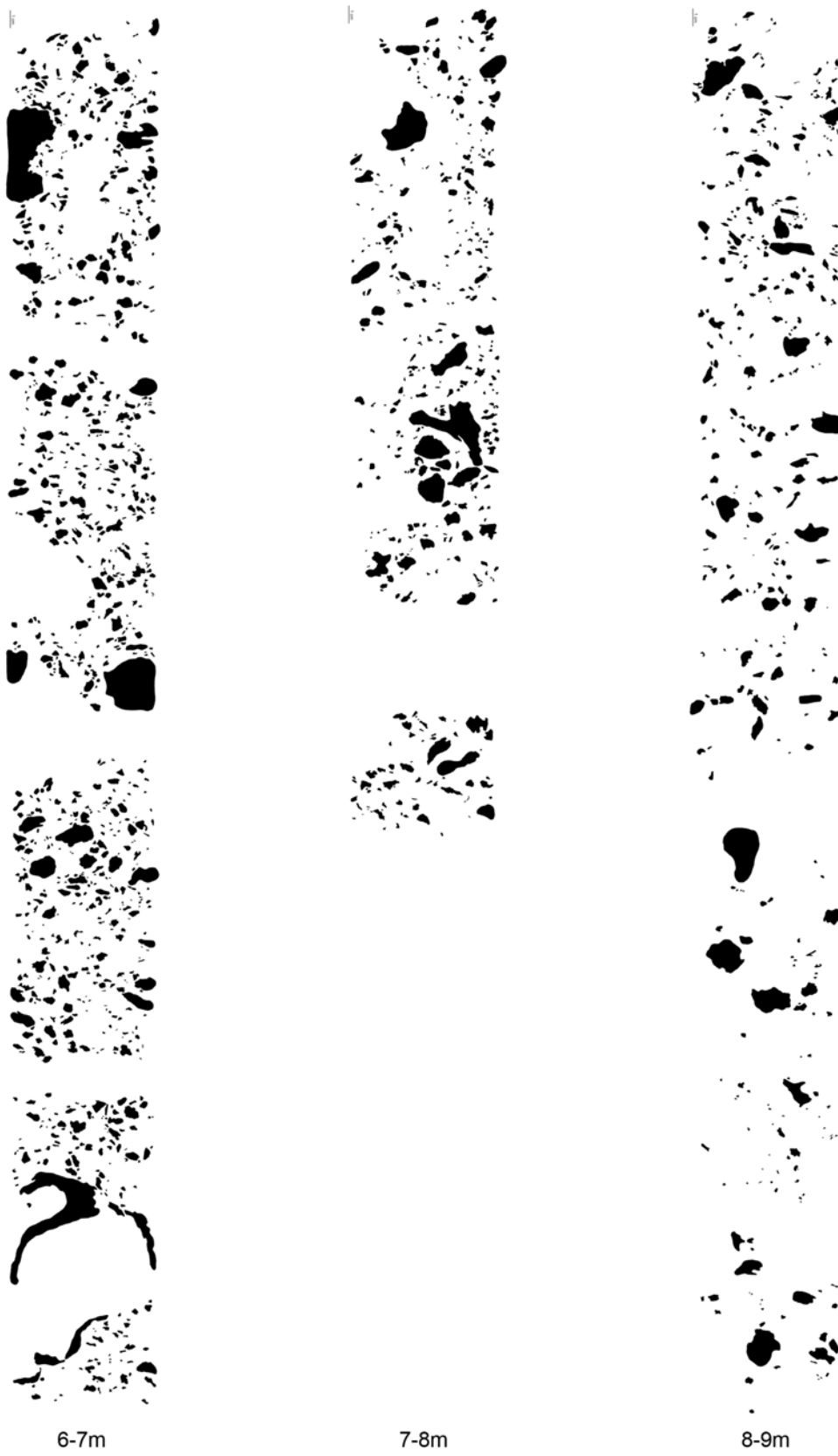


Fig. A.126.: Half core templates of Otting (melt particles 6 - 9 m)

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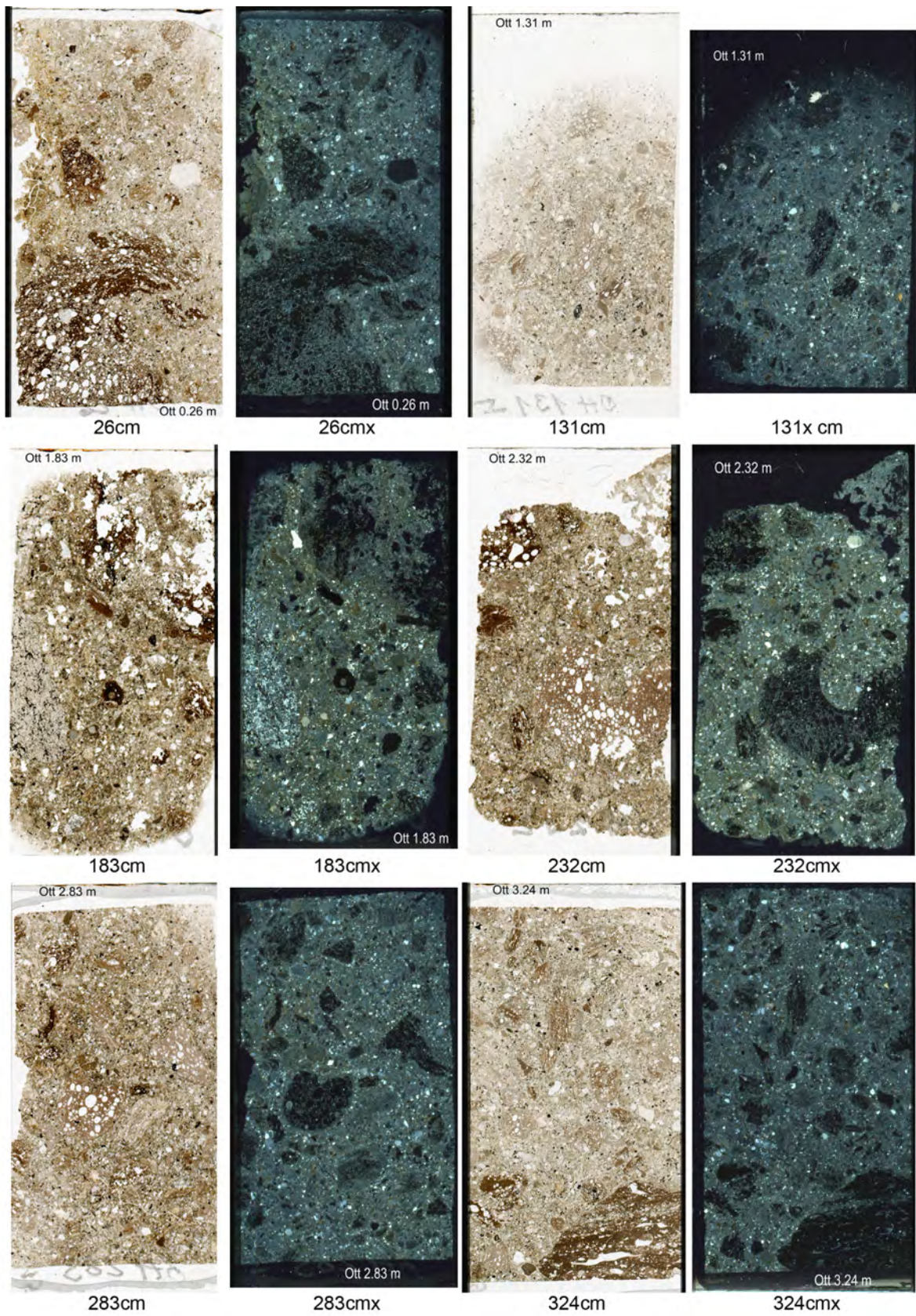


Fig. A.127.: Thin section photographs of Otting (26 - 324 cm)

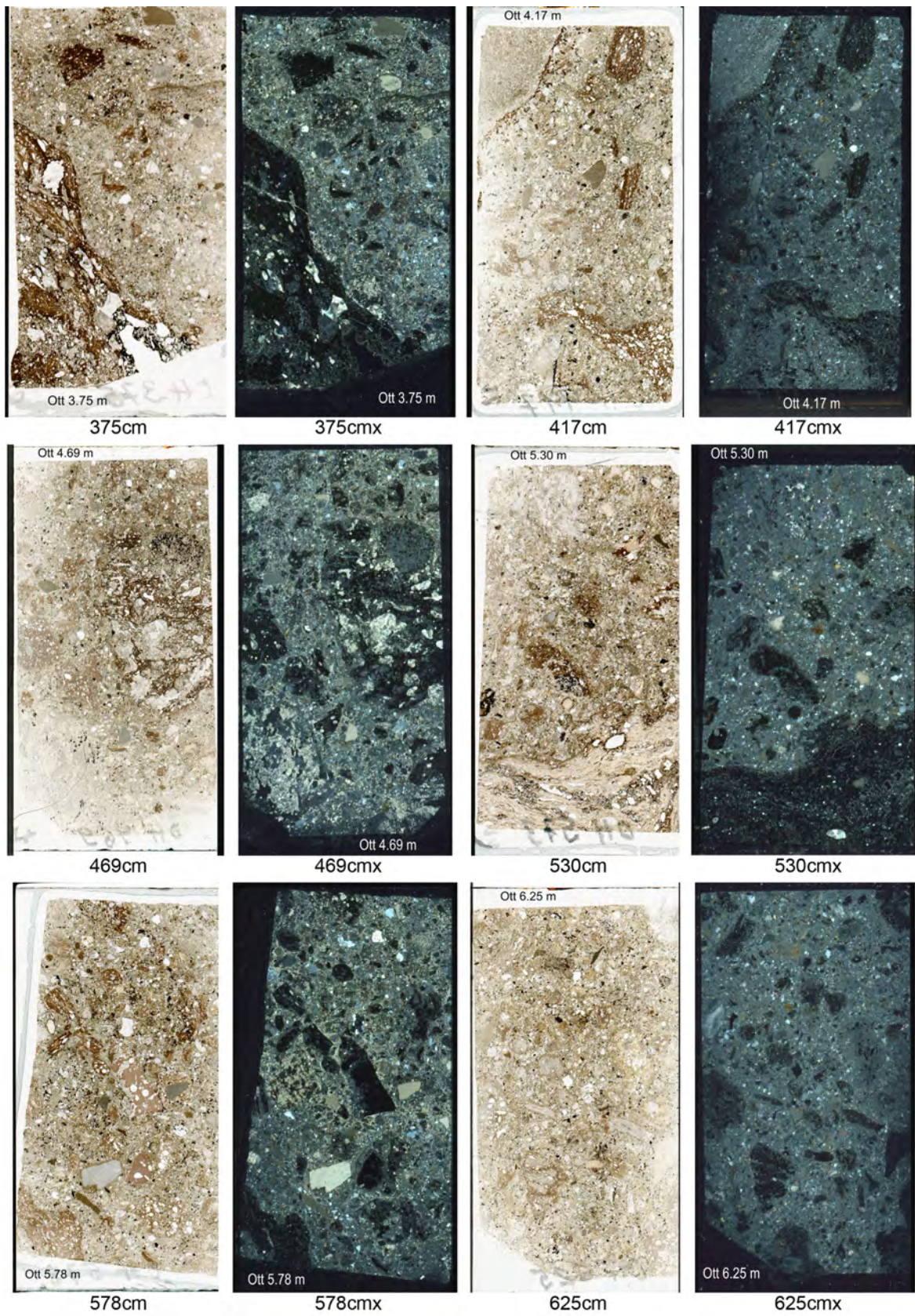


Fig. A.128.: Thin section photographs of Otting (375 - 625 cm)

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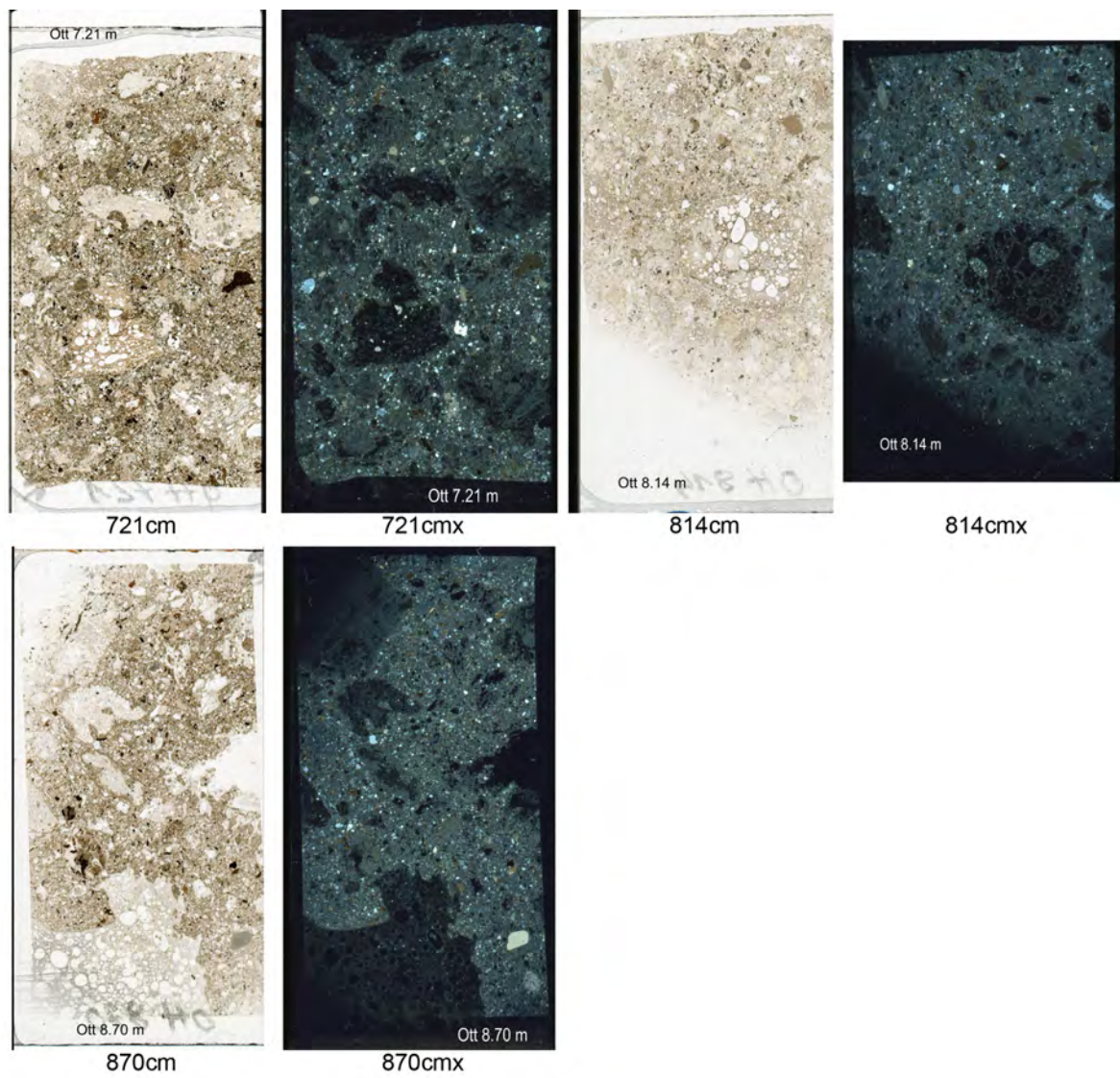


Fig. A.129.: Thin section photographs of Otting (721 - 870 cm)

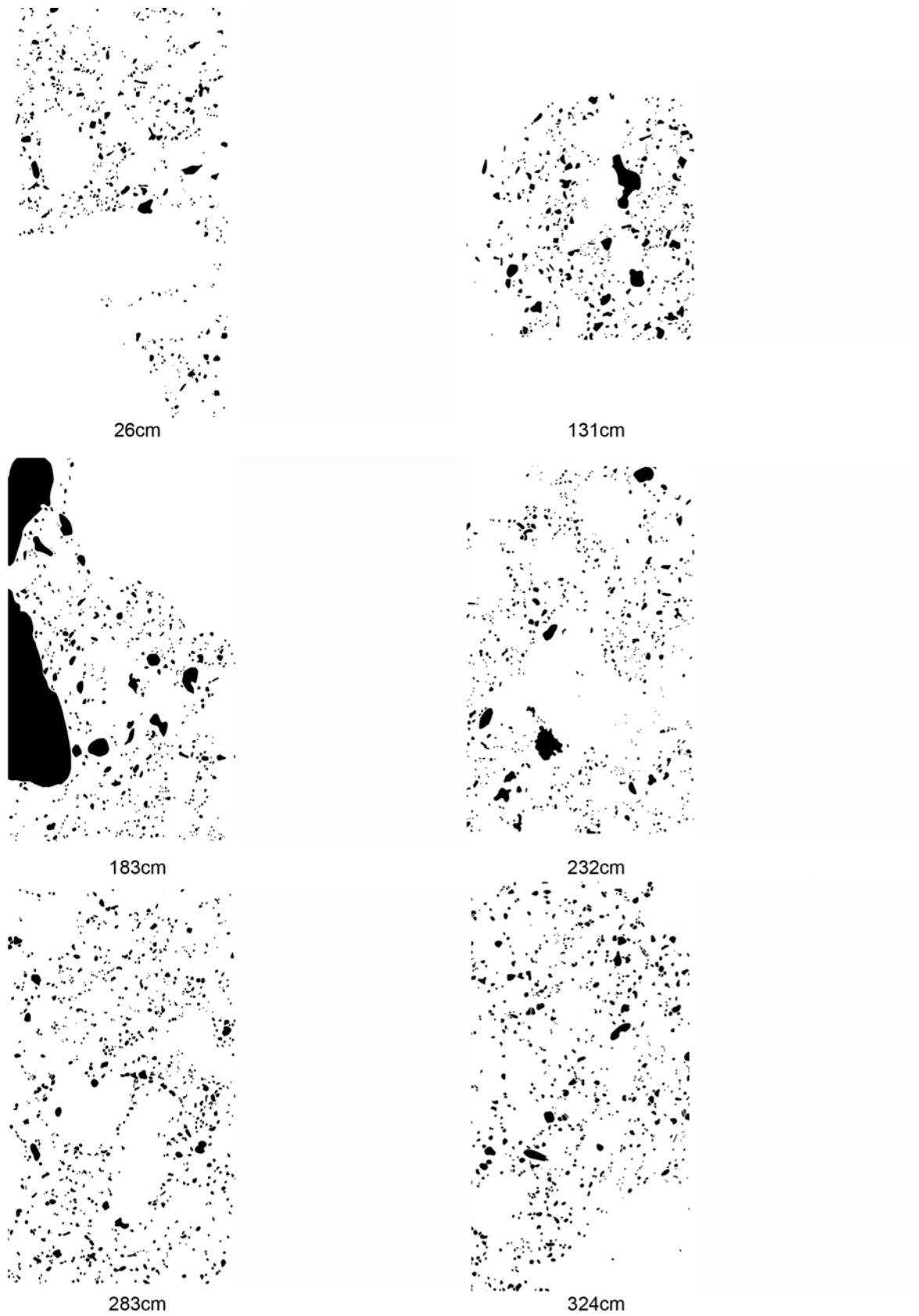


Fig. A.130.: Thin section templates of Otting (lithic clasts 26 - 324 cm)

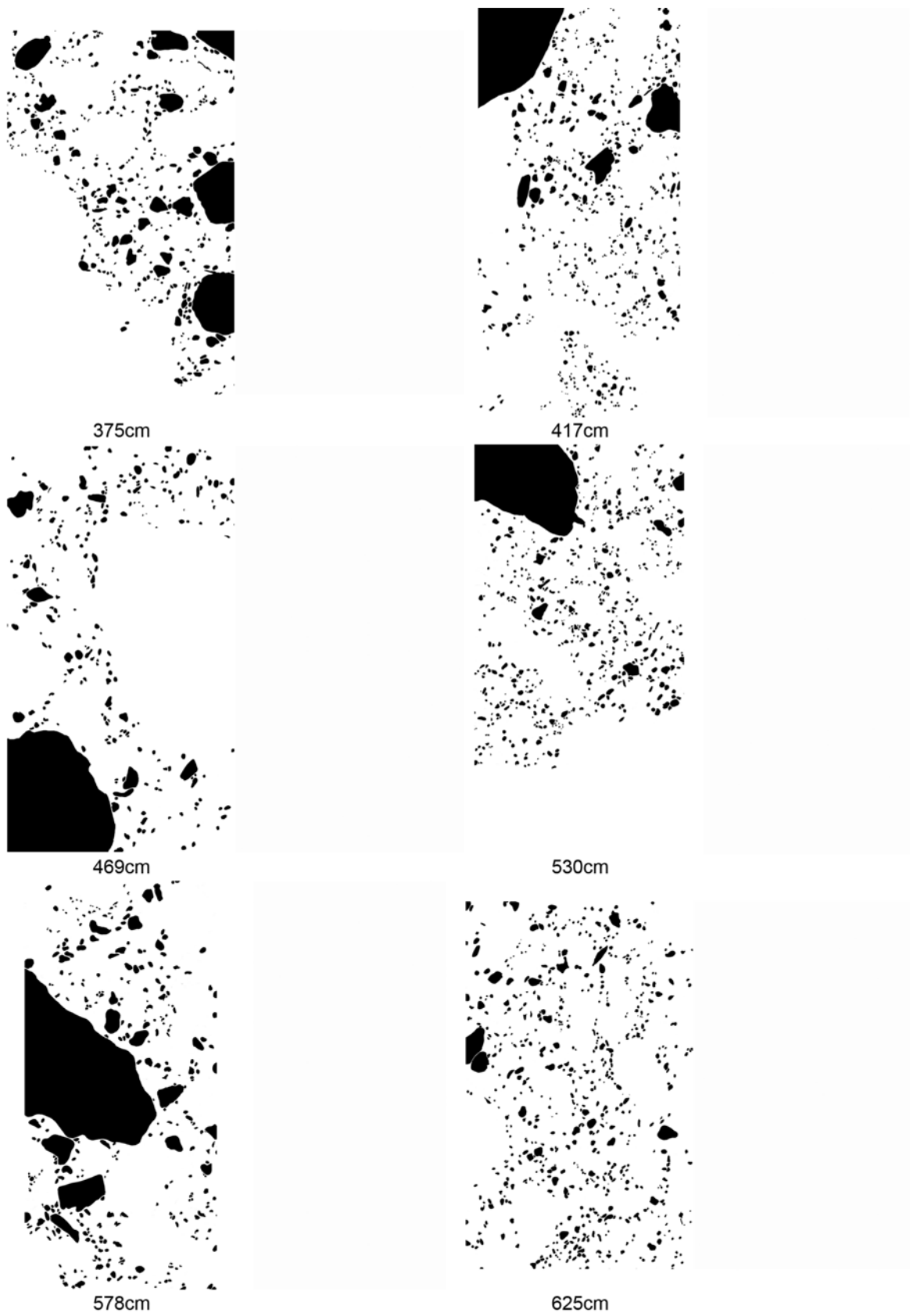


Fig. A.131.: Thin section templates of Otting (lithic clasts 375 - 625 cm)

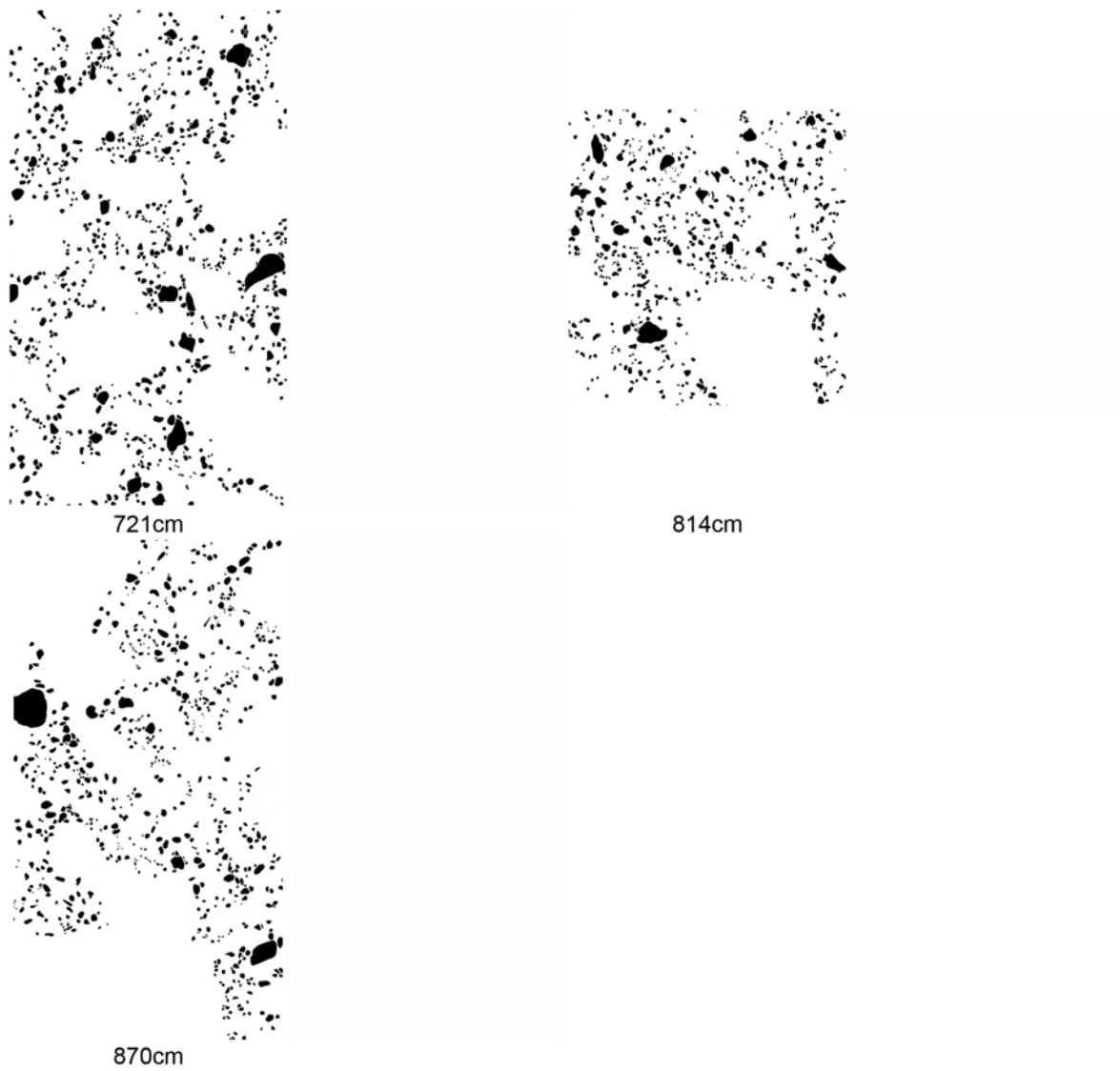
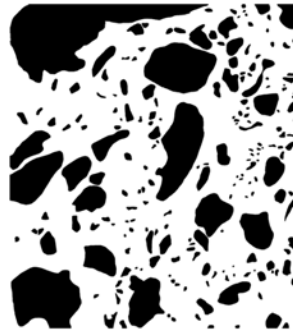


Fig. A.132.: Thin section templates of Otting (lithic clasts 721 - 870 cm)



26cm



131cm



183cm



232cm



283cm



324cm

Fig. A.133.: Thin section templates of Otting (melt particles 26 - 324 cm)

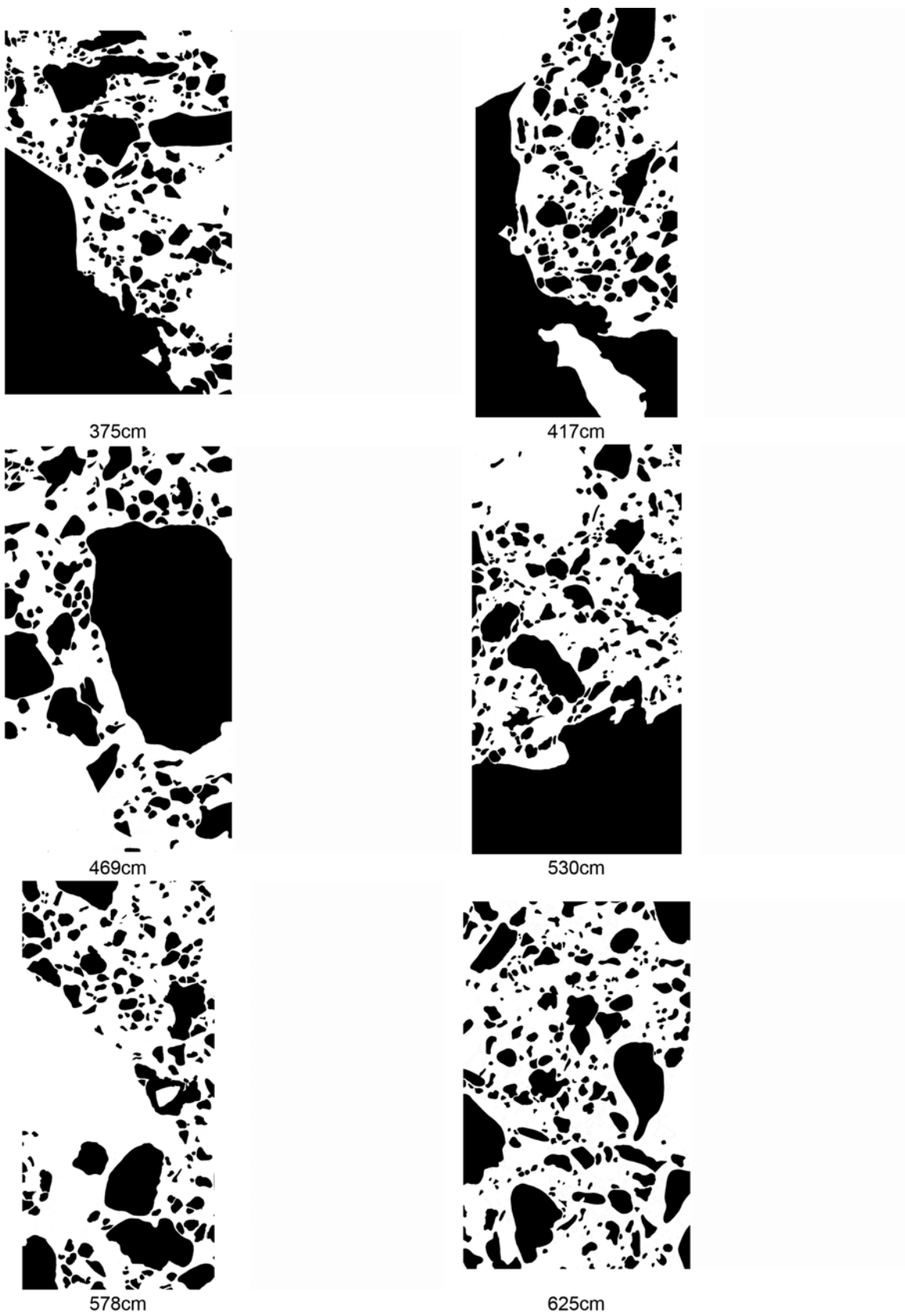
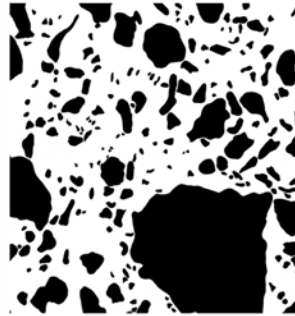


Fig. A.134.: Thin section templates of Otting (melt particles 375 - 625 cm)



721cm

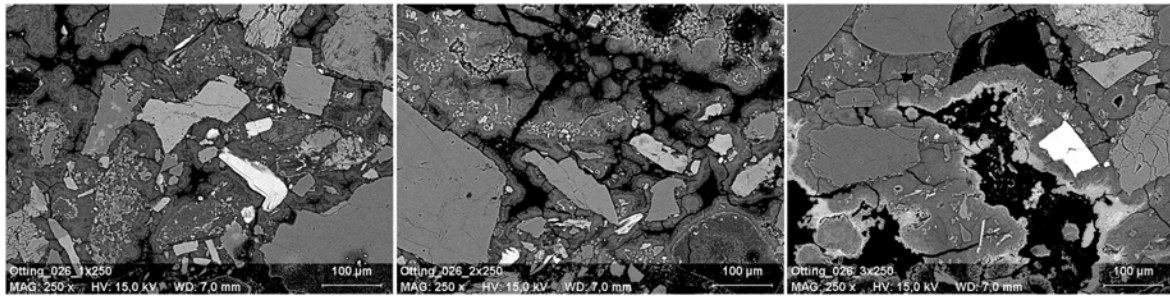


814cm



870cm

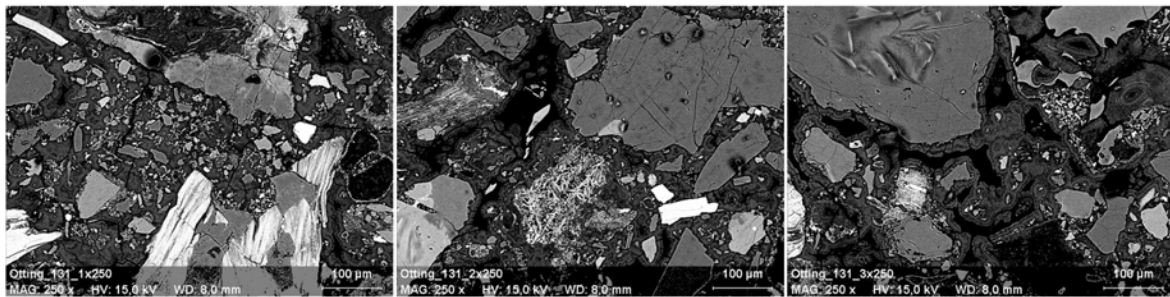
Fig. A.135.: Thin section templates of Otting (melt particles 721 - 870 cm)



026cm

026cm

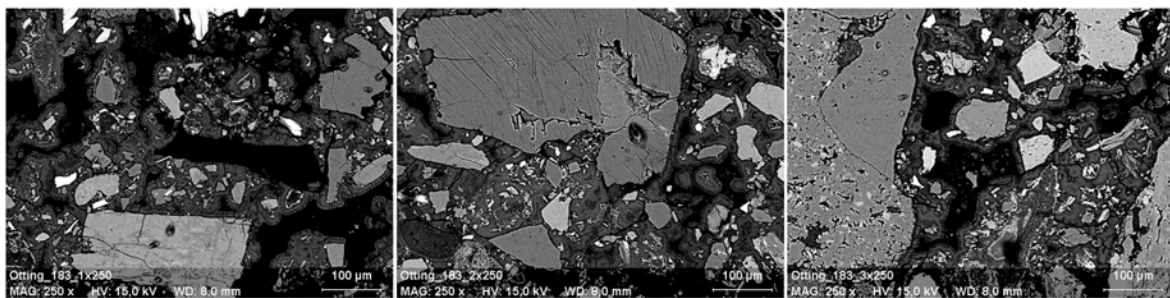
026cm



131cm

131cm

131cm



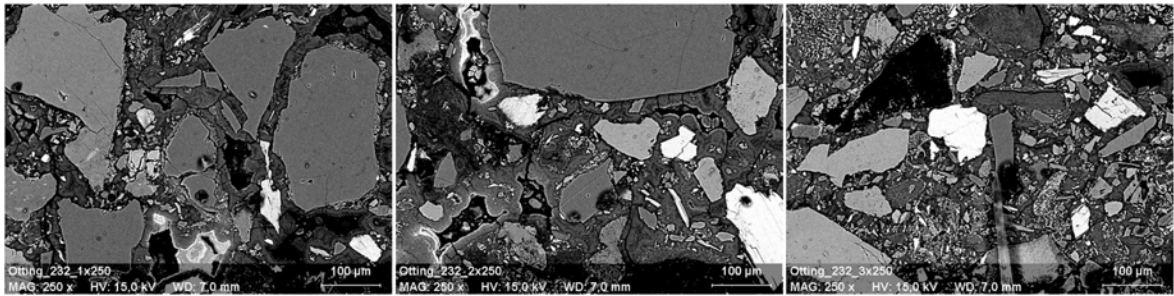
183cm

183cm

183cm

Fig. A.136.: SE pictures of Otting (26 - 183 cm)

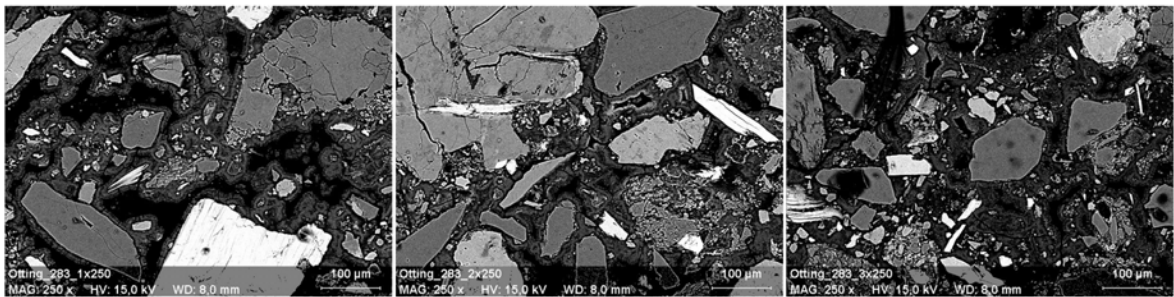
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232cm

232cm

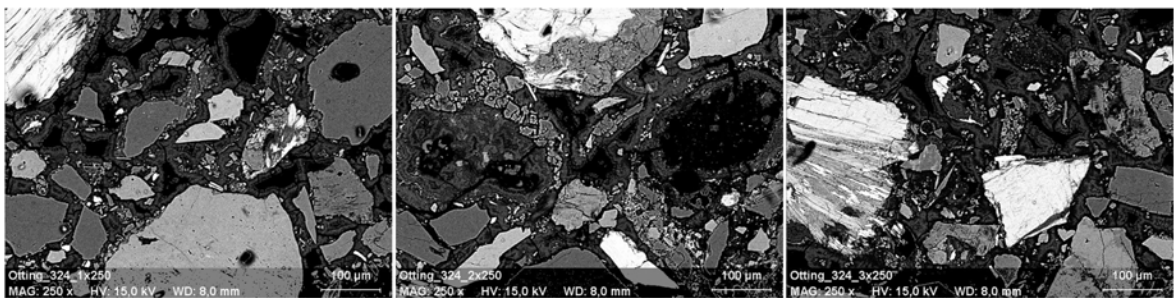
232cm



283cm

283cm

283cm

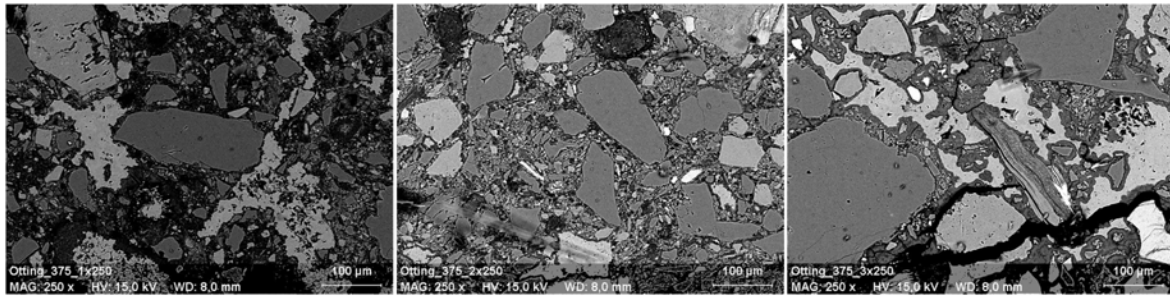


324cm

324cm

324cm

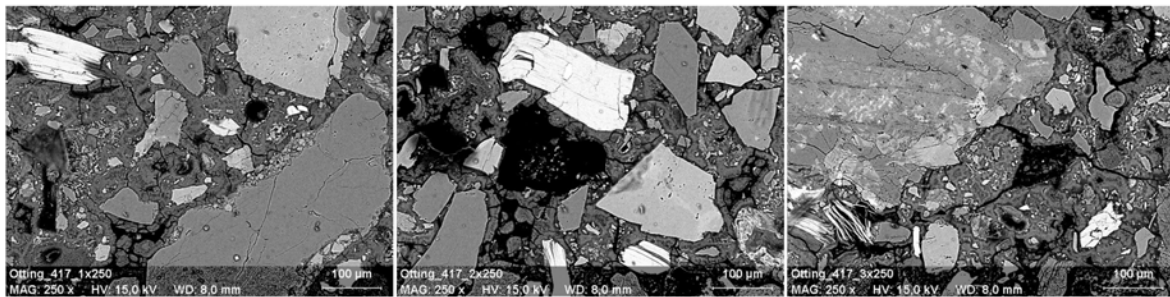
Fig. A.137.: SE pictures of Otting (232 - 324 cm)



375cm

375cm

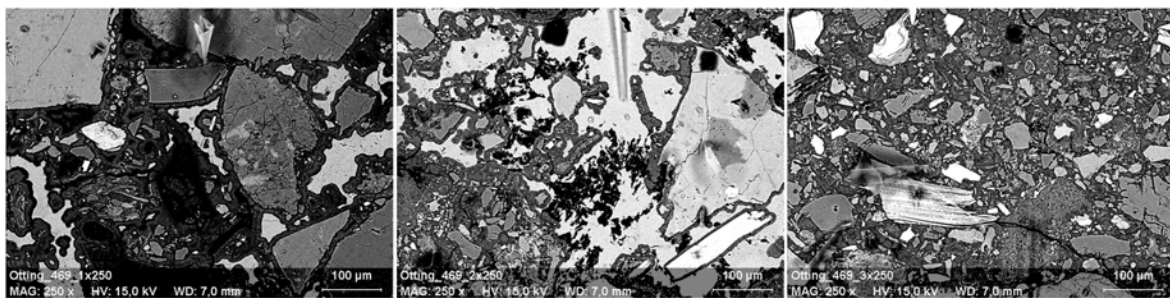
375cm



417cm

417cm

417cm



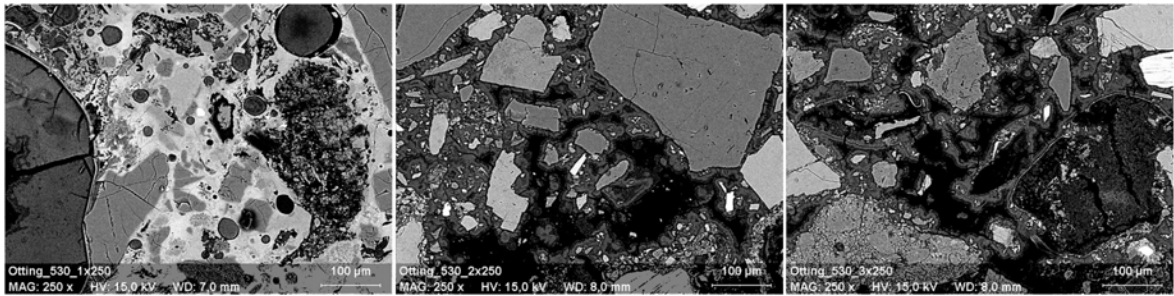
469cm

469cm

469cm

Fig. A.138.: SE pictures of Otting (375 - 469 cm)

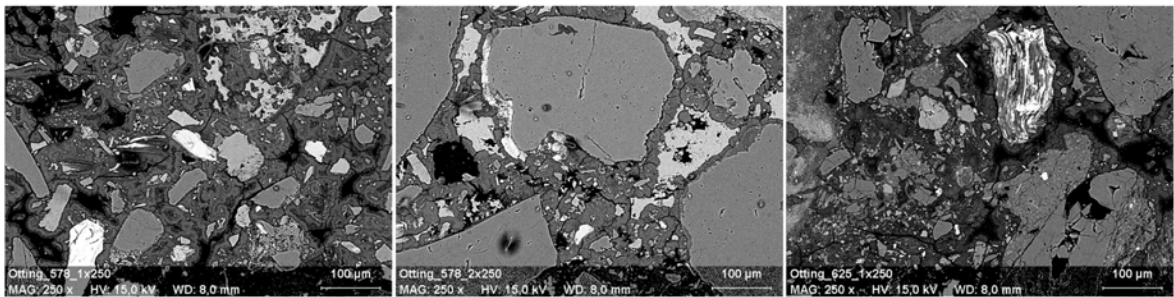
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530cm

530cm

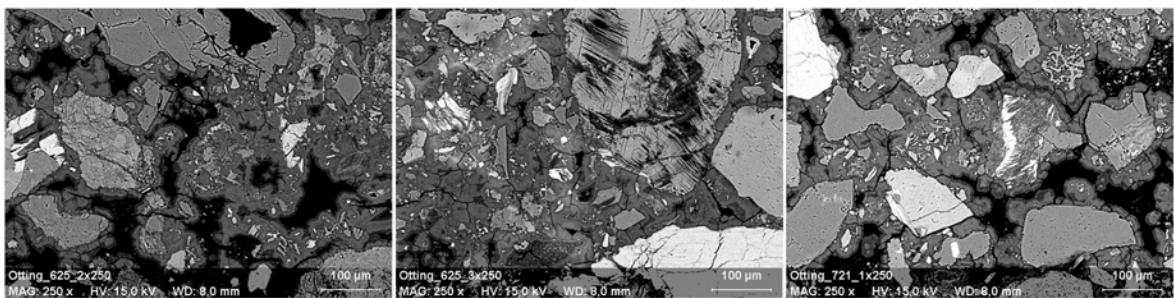
530cm



578cm

578cm

625cm

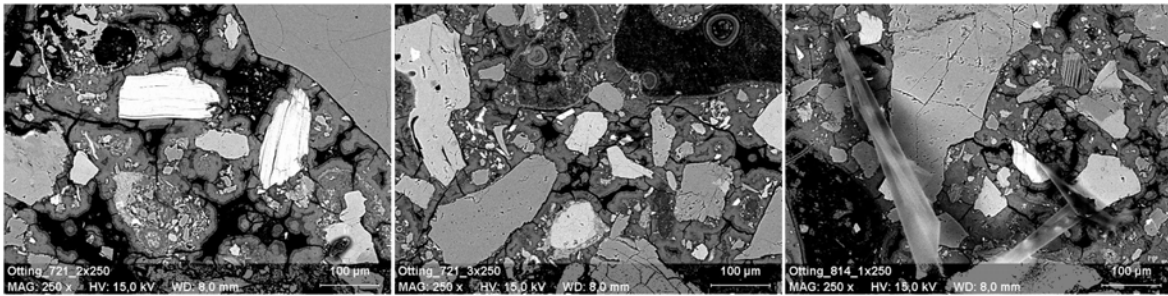


625cm

625cm

721cm

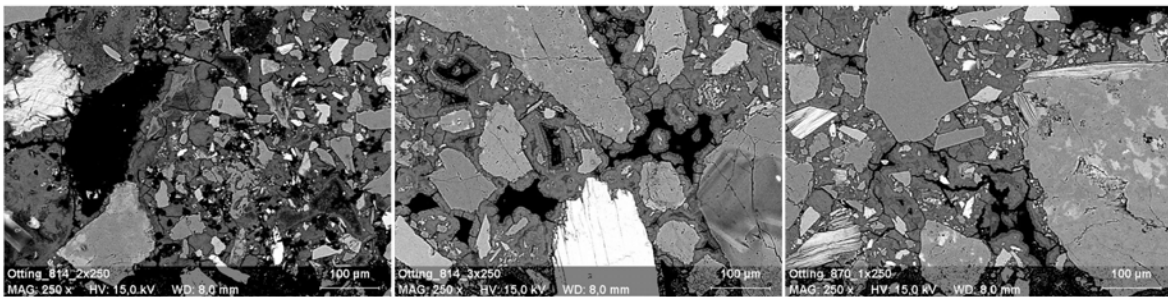
Fig. A.139.: SE pictures of Otting (530 - 721 cm)



721cm

721cm

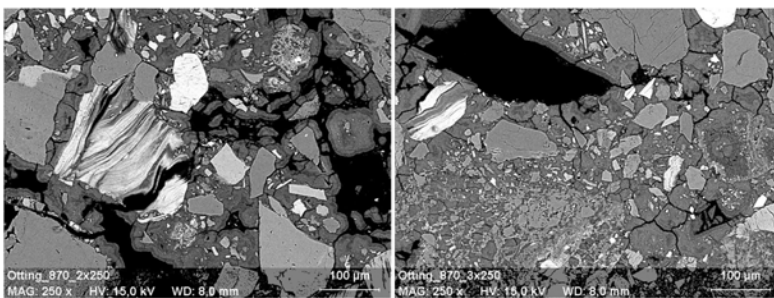
814cm



814cm

814cm

870cm



870cm

870cm

Fig. A.140.: SE pictures of Otting (721 - 870 cm)

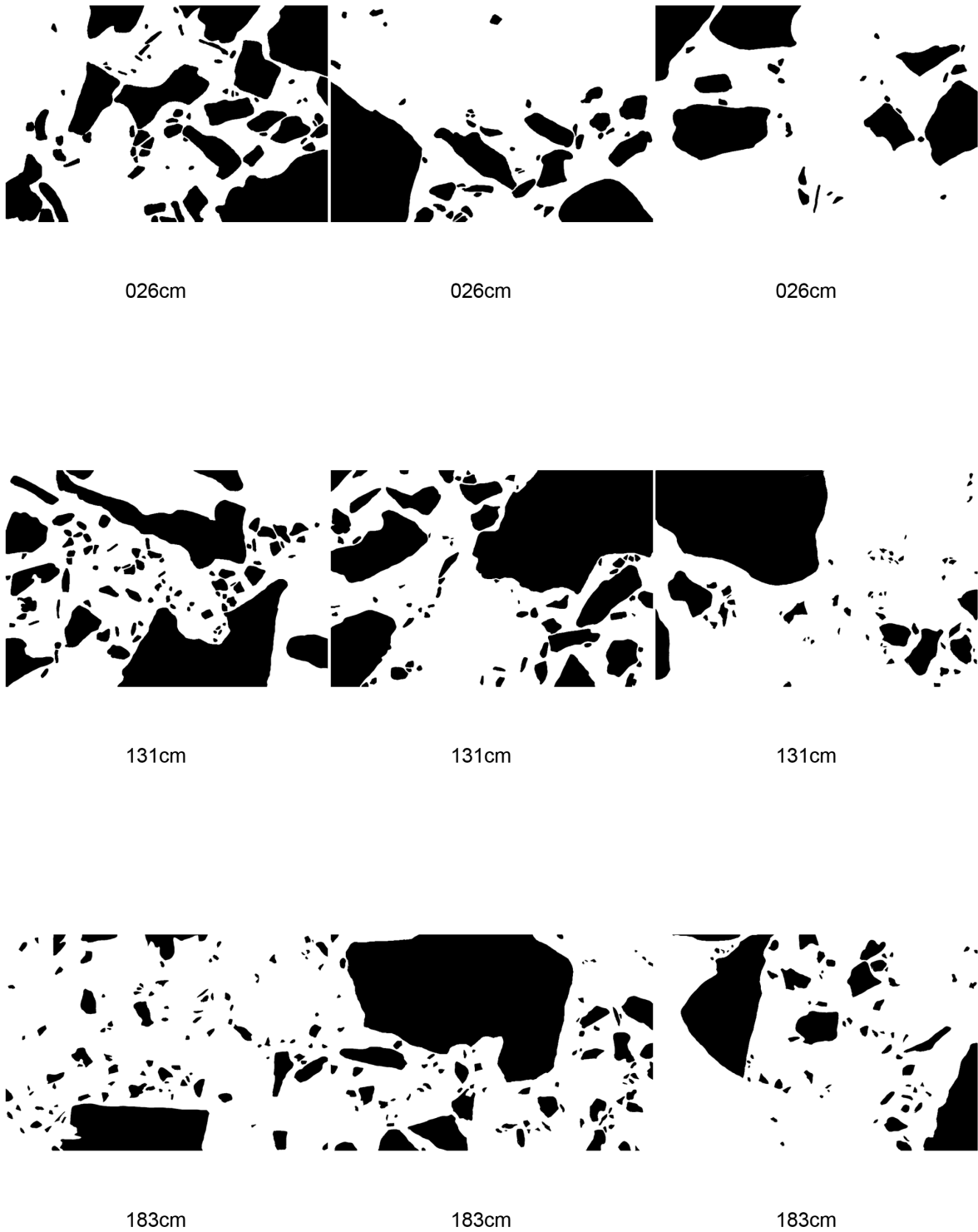


Fig. A.141.: SE templates of Otting (lithic clasts 26 - 183 cm)



232cm

232cm

232cm



283cm

283cm

283cm



324cm

324cm

324cm

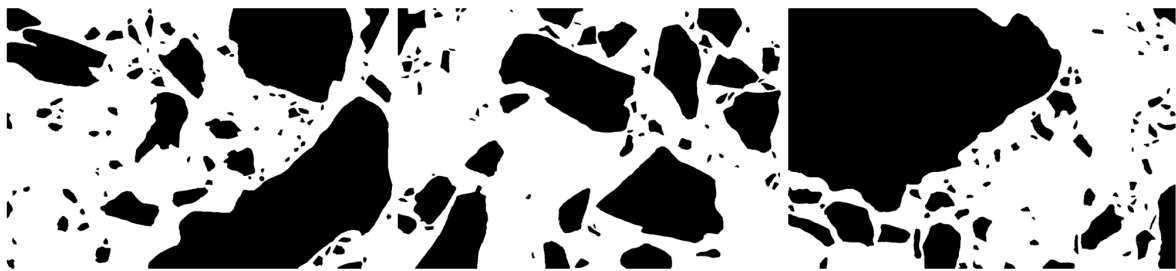
Fig. A.142.: SE templates of Otting (lithic clasts 232 - 324 cm)



375cm

375cm

375cm



417cm

417cm

417cm



469cm

469cm

469cm

Fig. A.143.: SE templates of Otting (lithic clasts 375 - 469 cm)

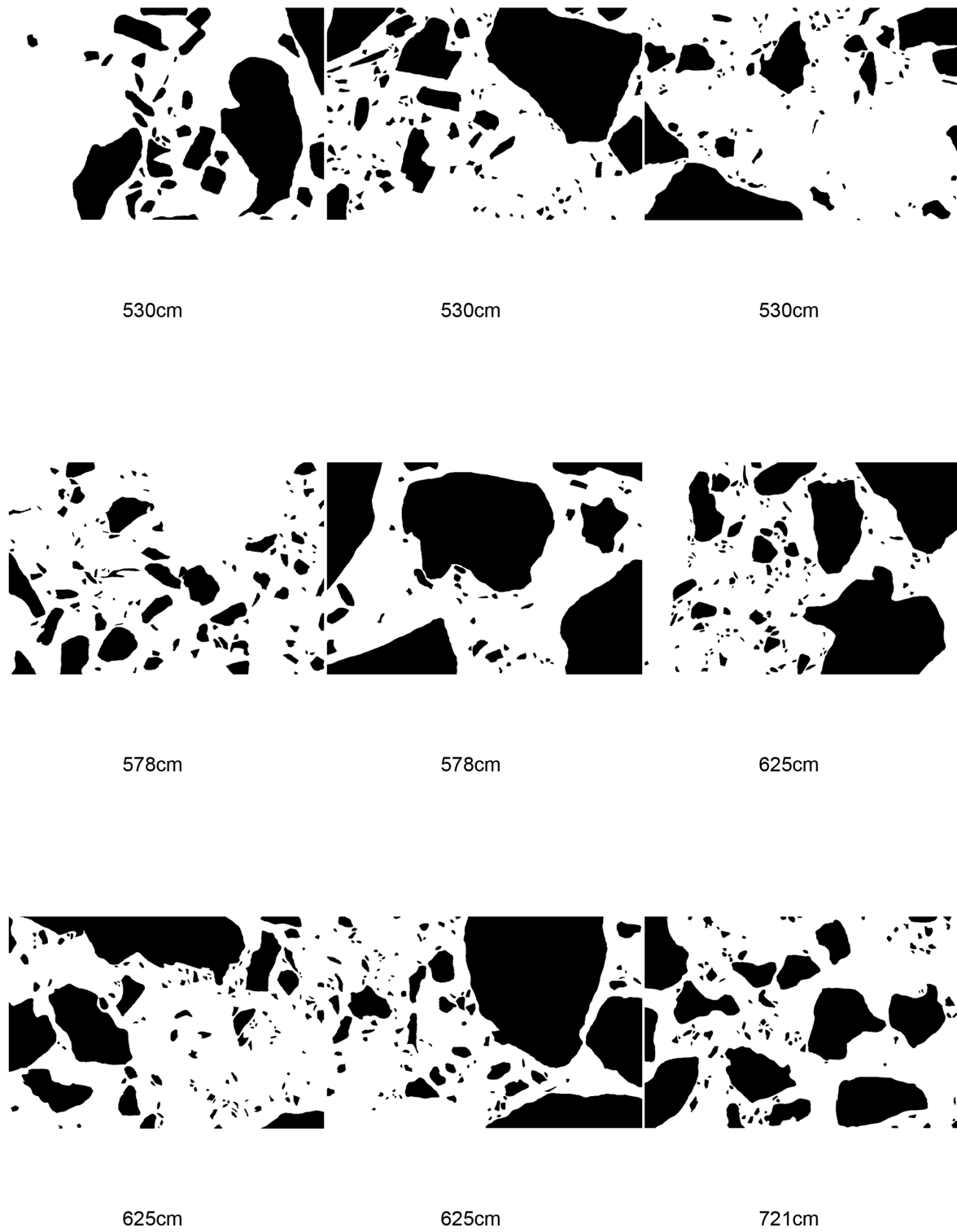


Fig. A.144.: SE templates of Otting (lithic clasts 530 - 721 cm)

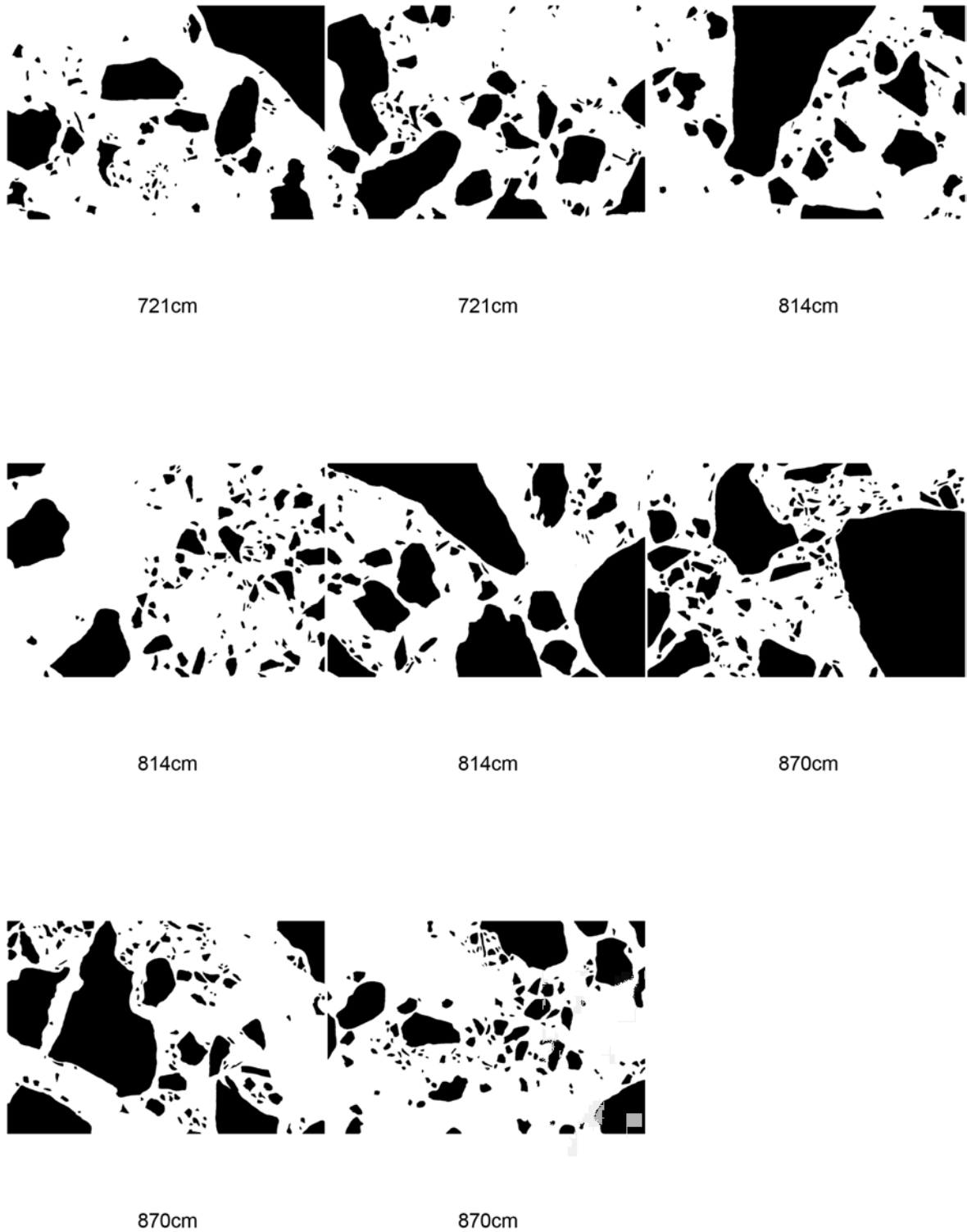


Fig. A.145.: SE templates of Otting (lithic clasts 721 - 870 cm)

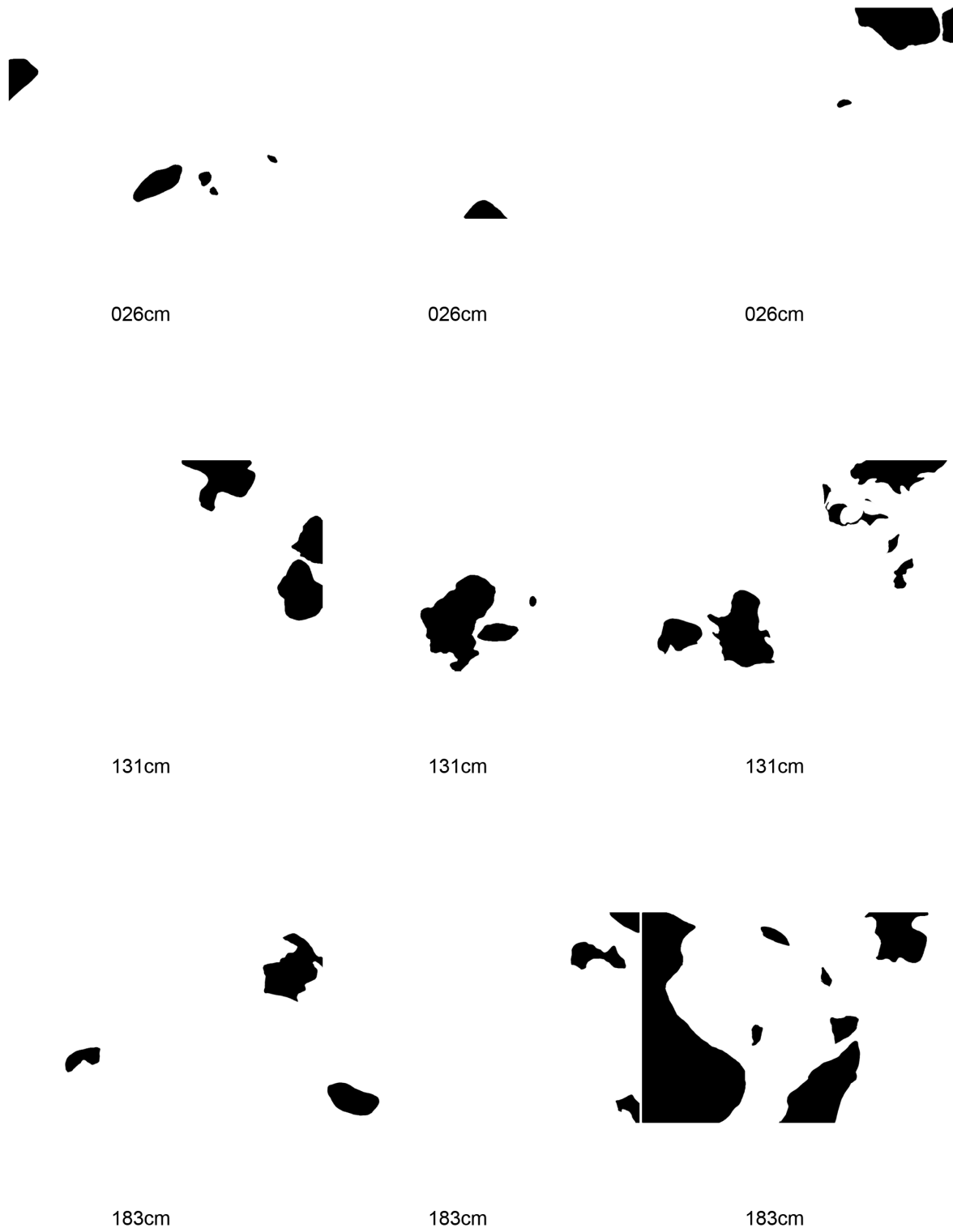


Fig. A.146.: SE templates of Otting (melt particles 26 - 183 cm)

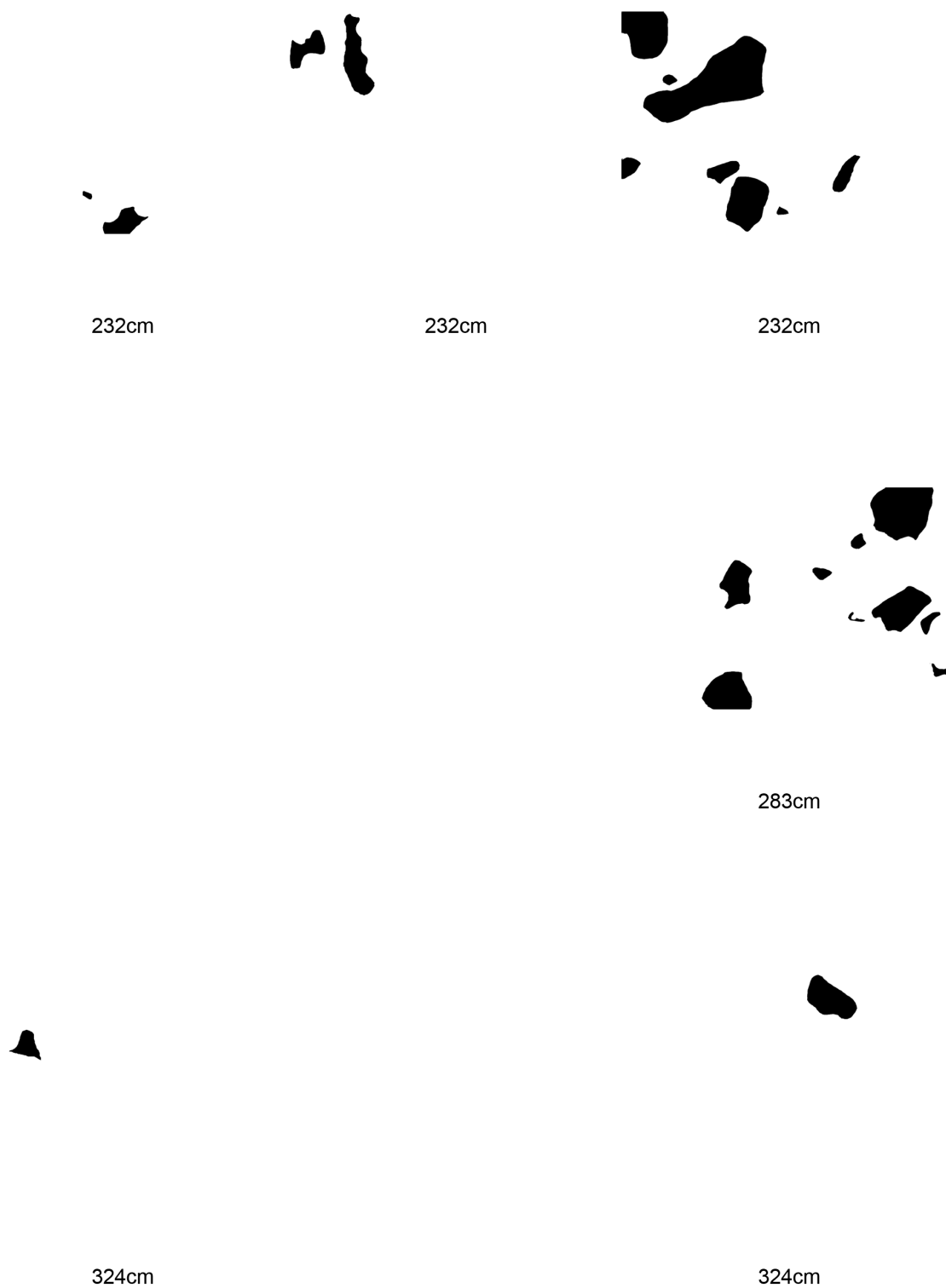


Fig. A.147.: SE templates of Otting (melt particles 232 - 324 cm)

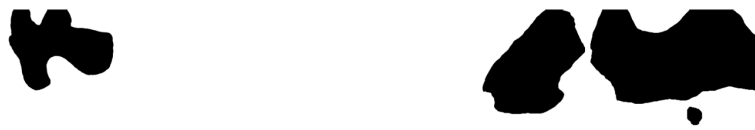


Fig. A.148.: SE templates of Otting (melt particles 375 - 469 cm)

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Fig. A.149.: SE templates of Otting (melt particles 530 - 721 cm)



721cm

721cm



814cm

814cm



870cm

Fig. A.150.: SE templates of Otting (melt particles 721 - 870 cm)

B. Appendix 2

Grain size distribution of suevite for lithic clasts and melt particles. Size equals $r = \sqrt{(A \cdot B)}$ where A = length of major axis and B = length of minor axis. Black bars: from macroscopic analysis, with sampling width of 1 to 63 mm (0 to -6 ϕ), red bars: from thin section analysis, with sampling width of 0.25 to 4 mm (2 to -2 ϕ), blue bars from SEM analyses, with sampling width of 0.016 to 0.25 mm (6 to 2 ϕ). At 0 to -0.5 ϕ the red bar of thin section analysis partially overlies the black bar of macroscopic analysis.

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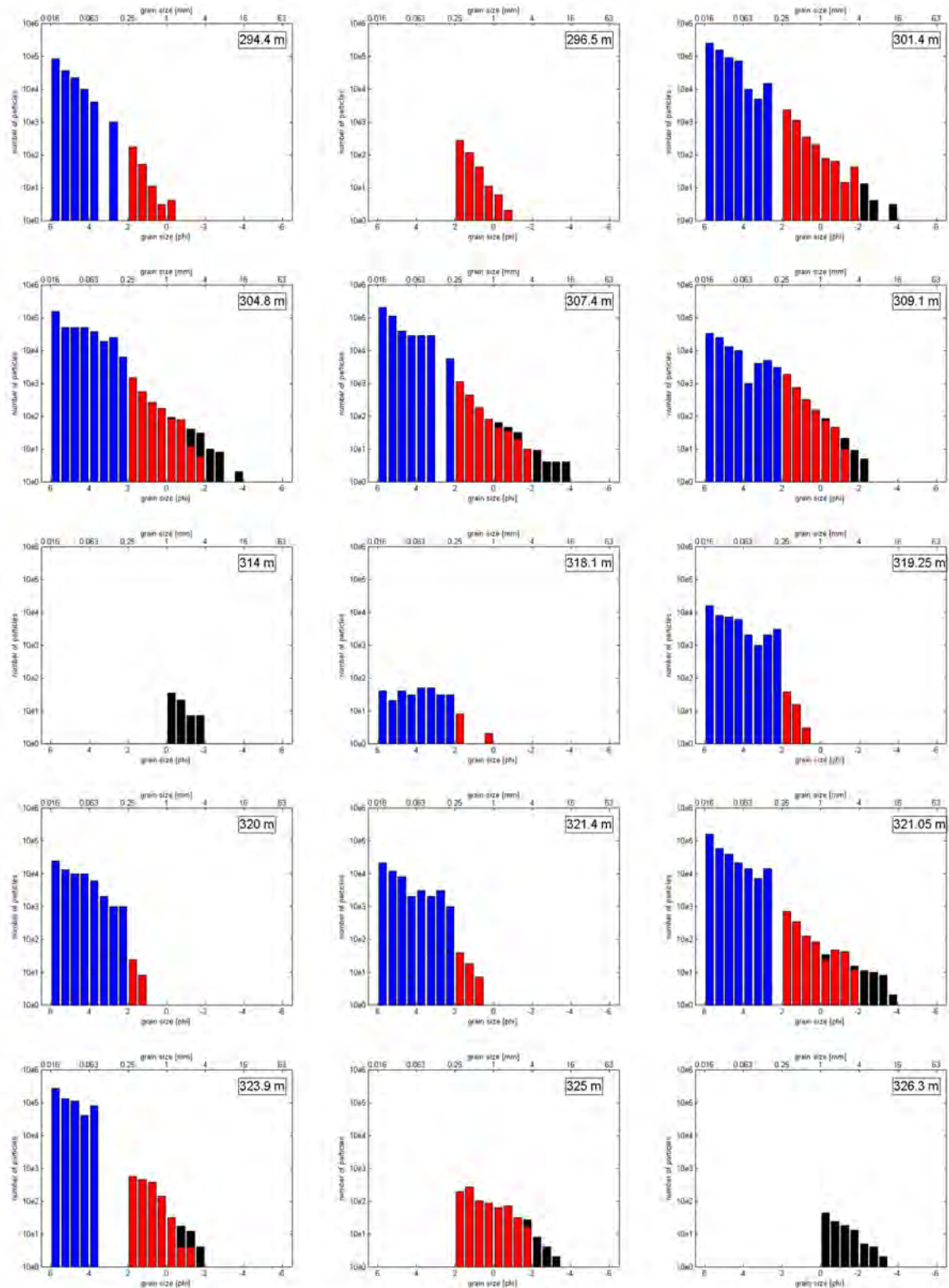


Fig. B.1.: Lithic clasts of FBN73 (294.4 - 326.3 m).

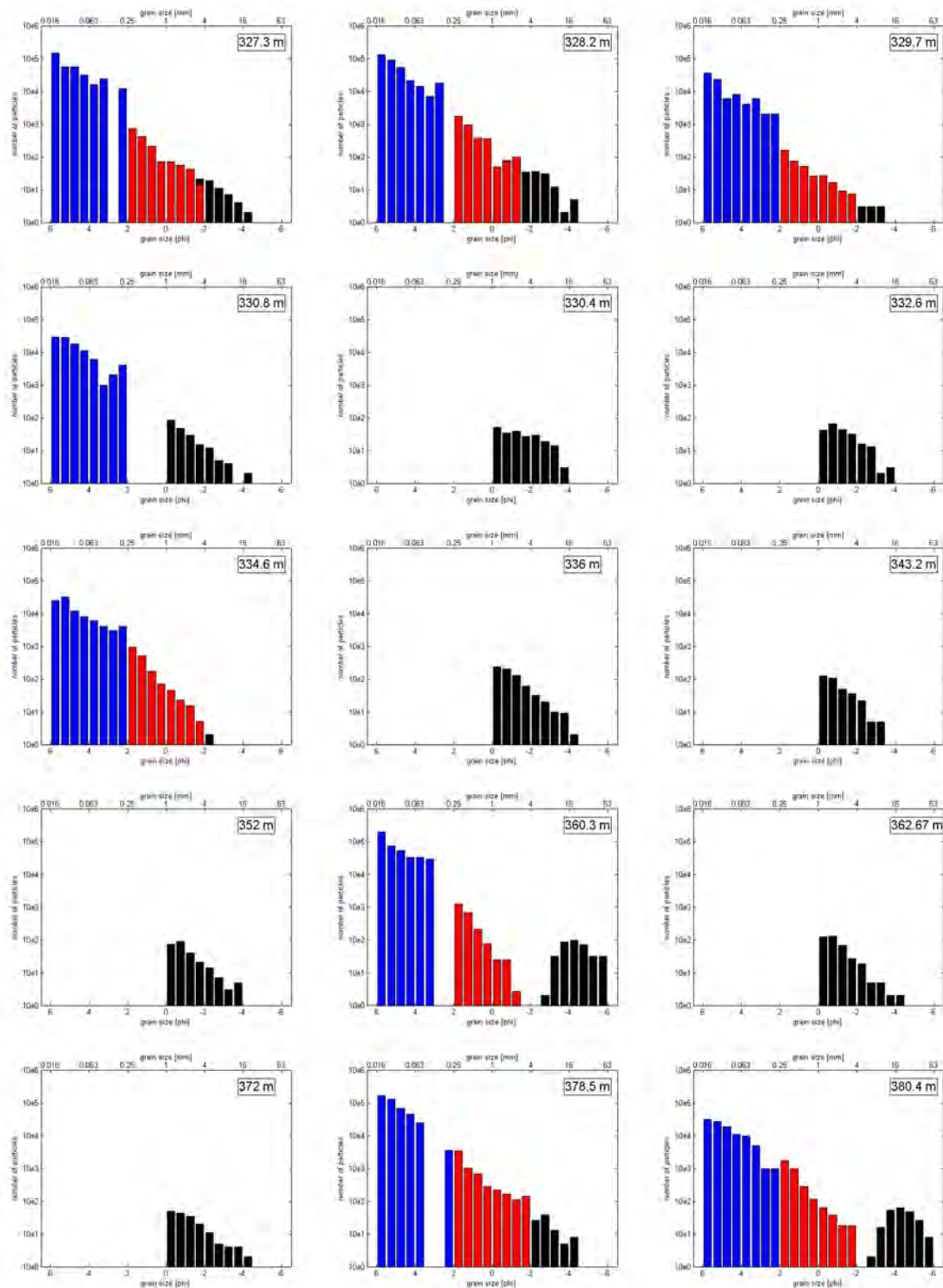


Fig. B.2.: Lithic clasts of FBN73 (327.3 - 380.4 m).

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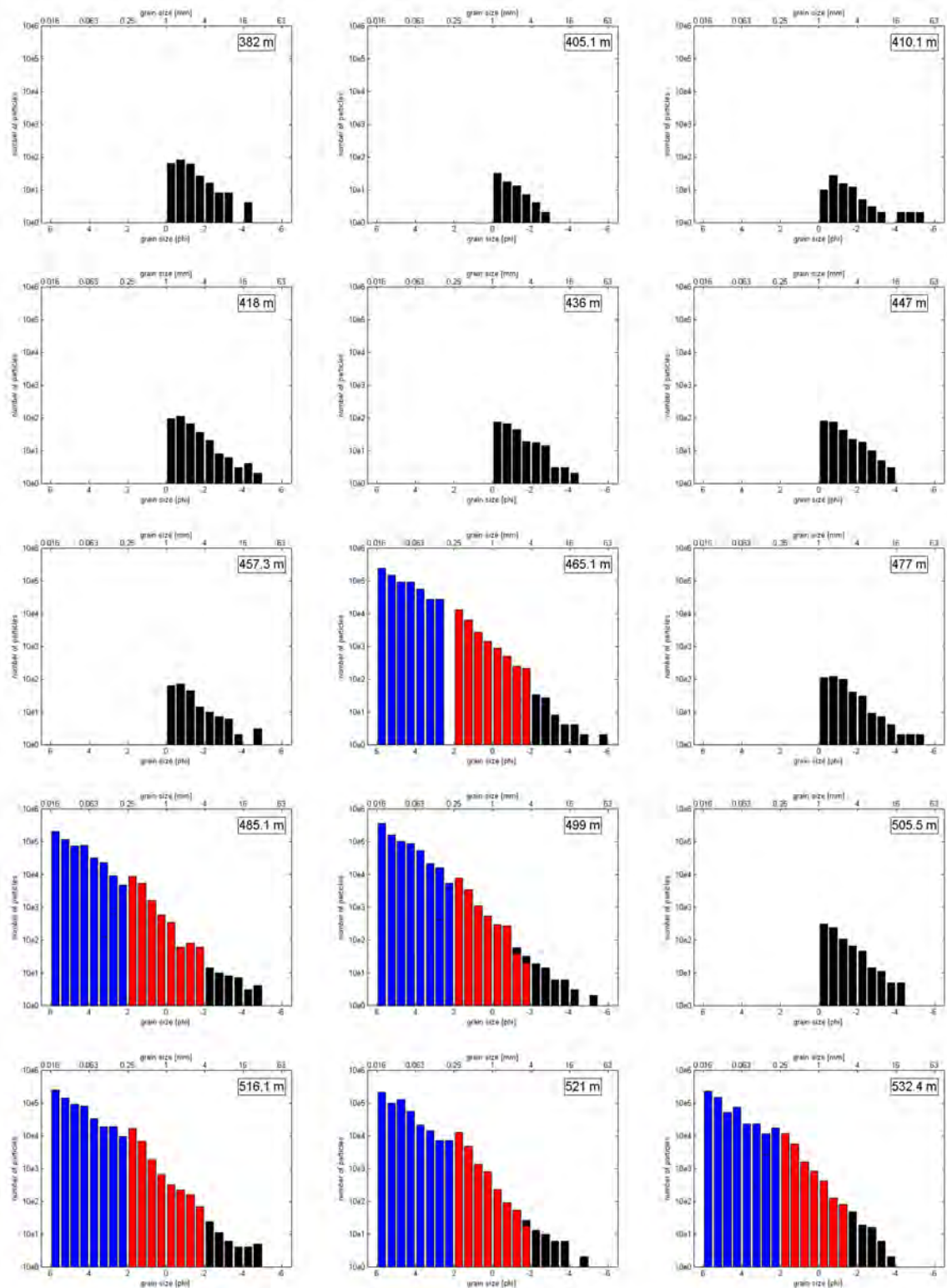


Fig. B.3.: Lithic clasts of FBN73 (382 - 532.4 m).

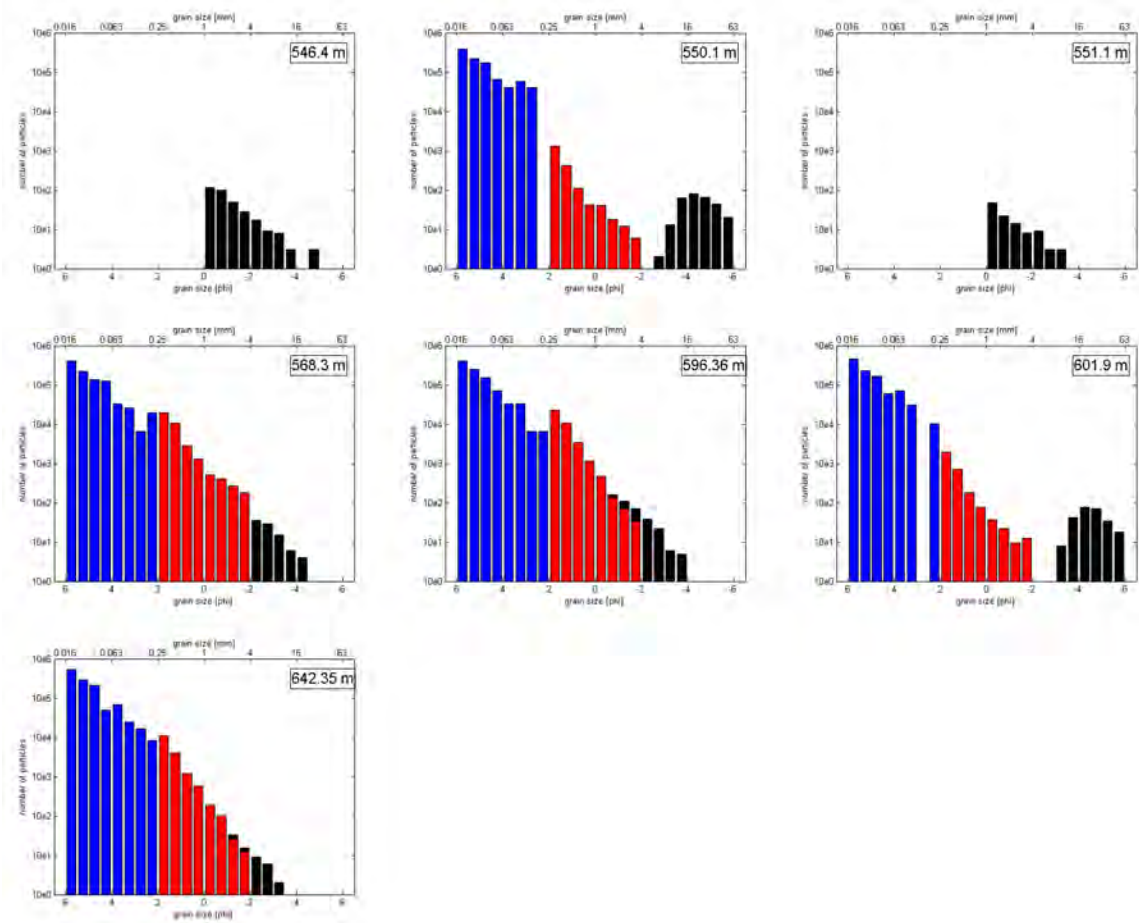


Fig. B.4.: Lithic clasts of FBN73 (546.4 - 642.35 m).

B. Appendix 2

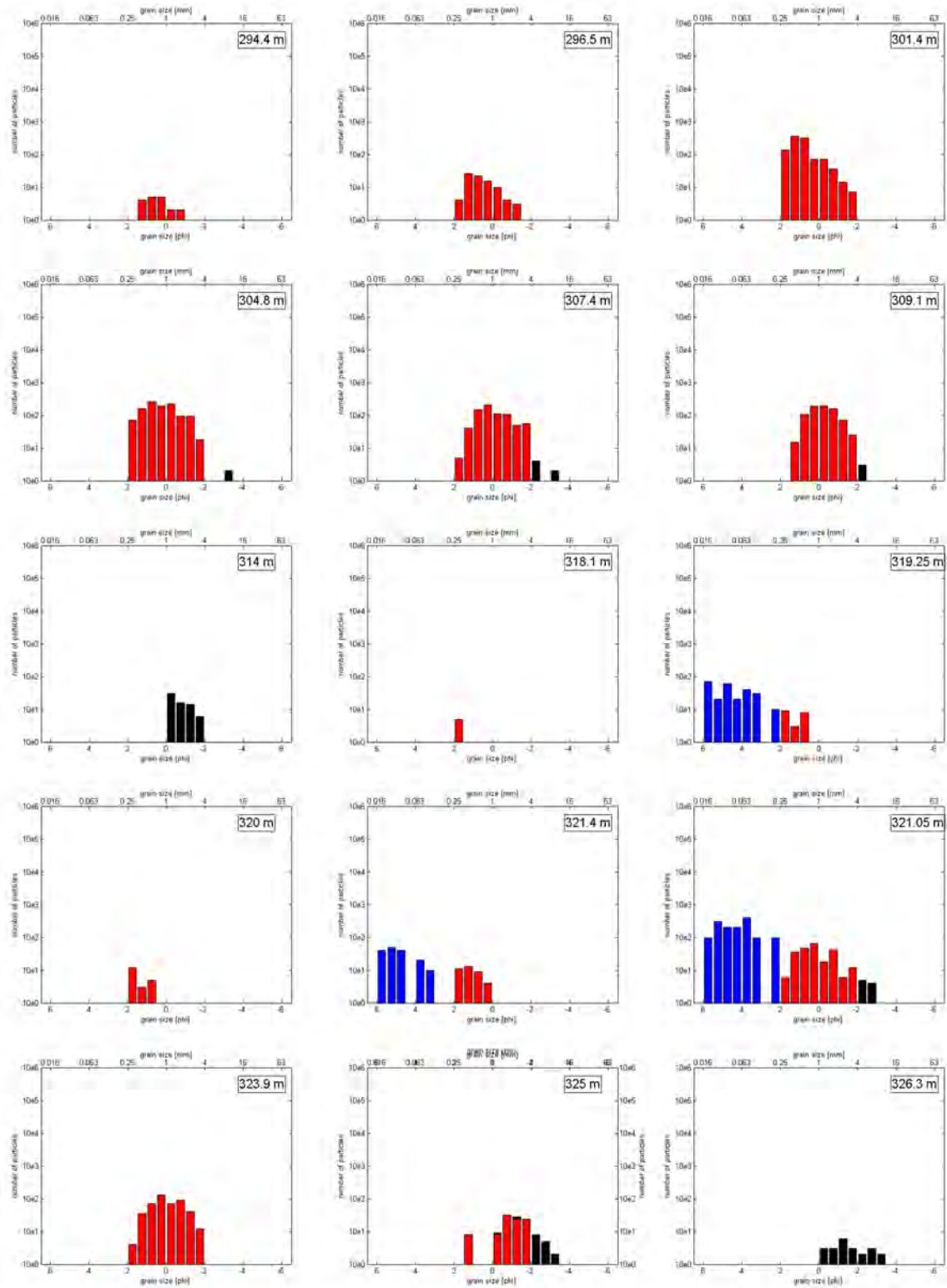


Fig. B.5.: Melt particles of FBN73 (294.4 - 326.3 m).

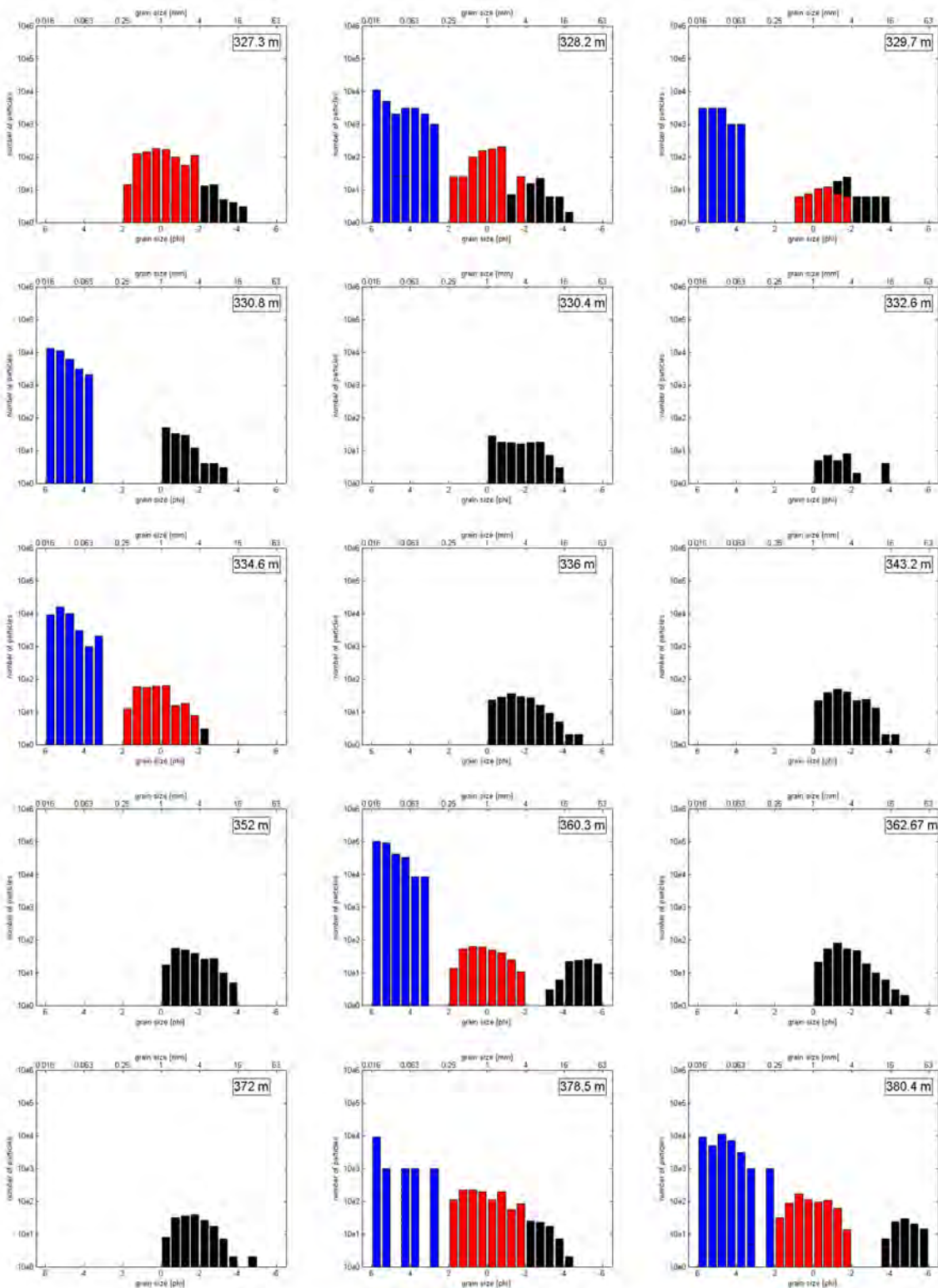


Fig. B.6.: Melt particles of FBN73 (327.3 - 380.4 m).

B. Appendix 2

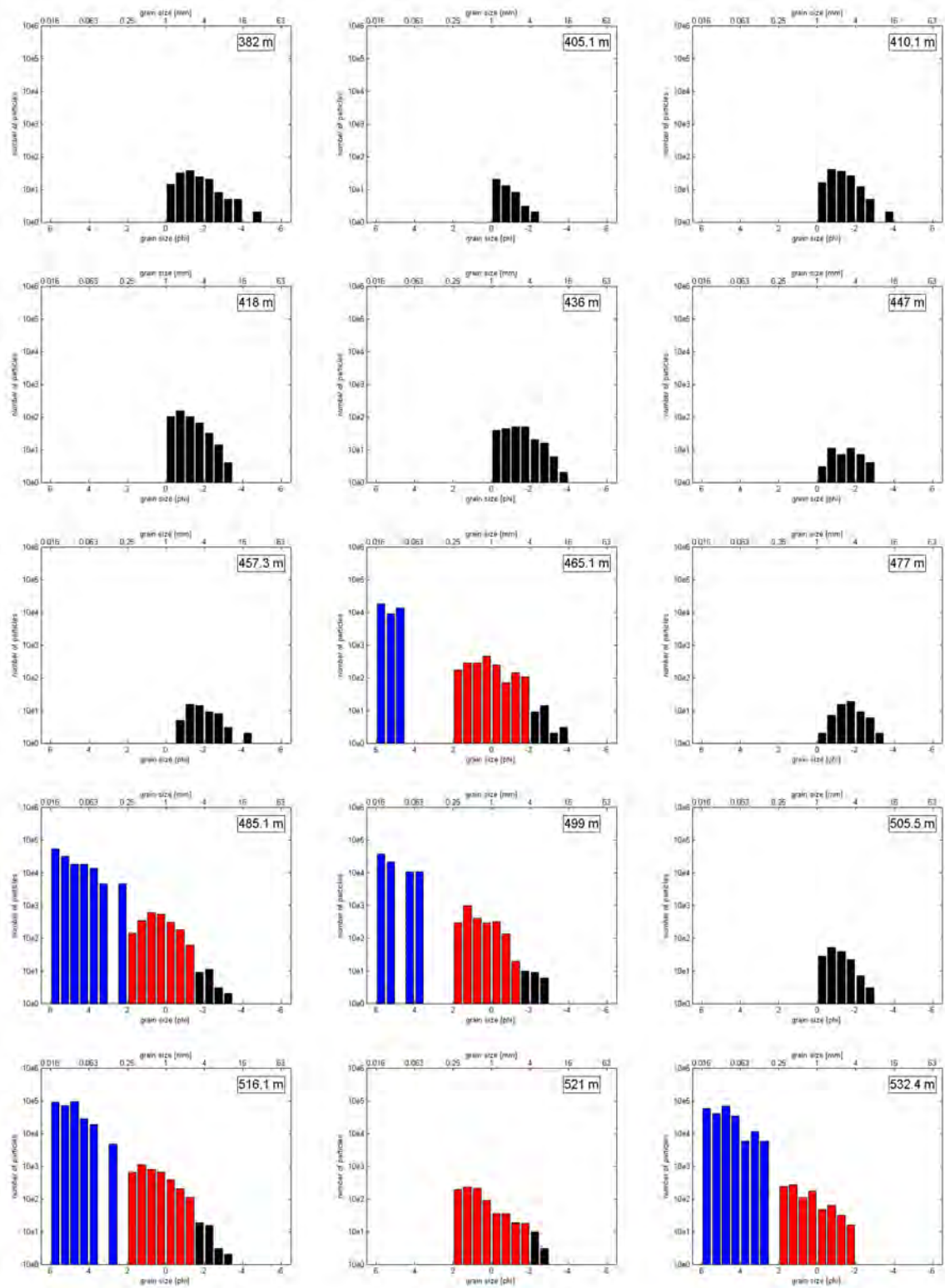


Fig. B.7.: Melt particles of FBN73 (382 - 532.4 m).

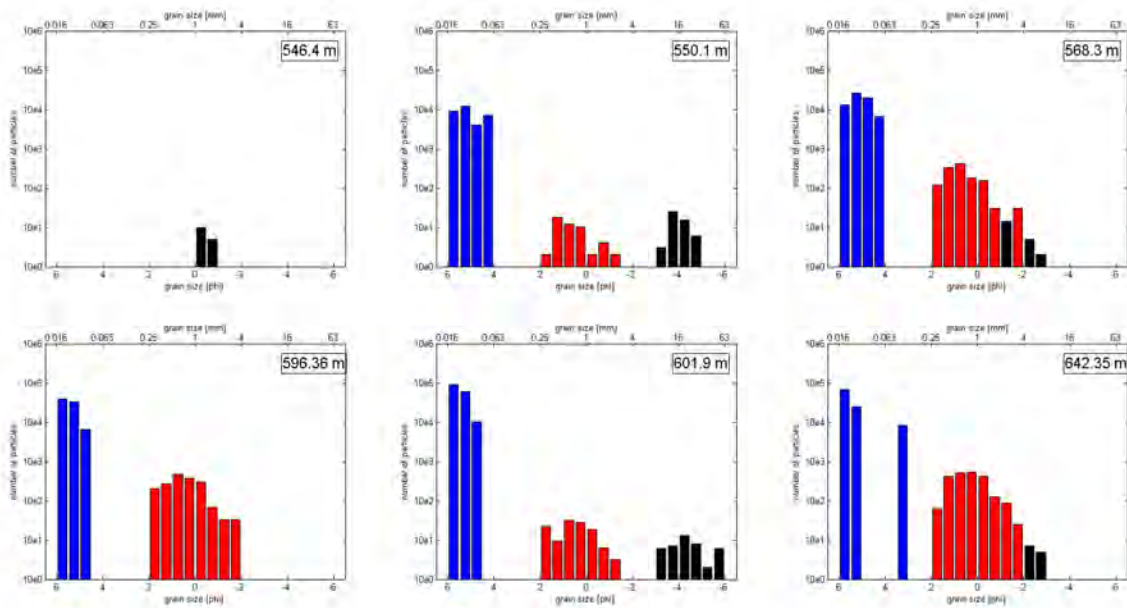


Fig. B.8.: Melt particles of FBN73 (546.4 - 642.35 m).

B. Appendix 2

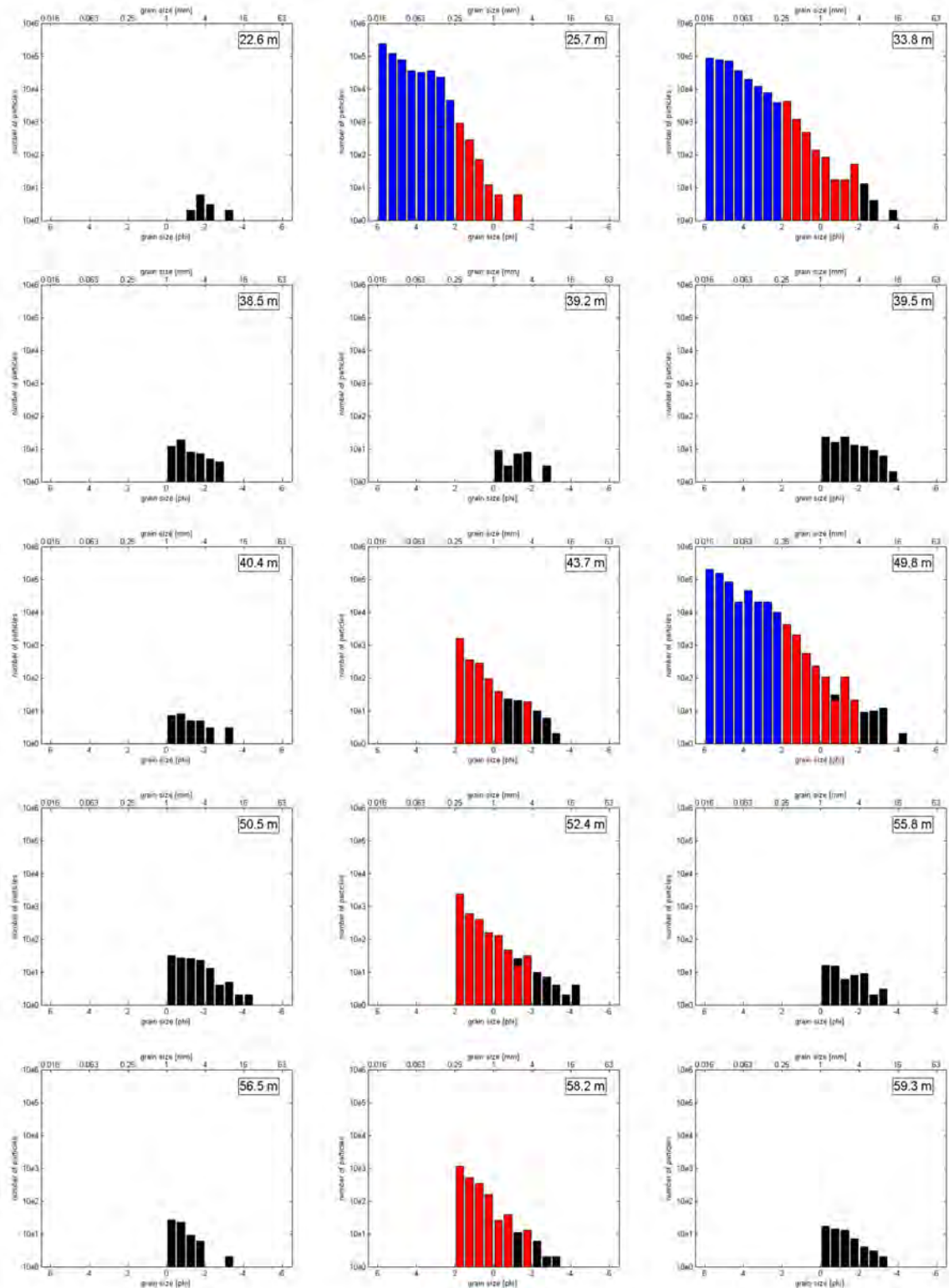


Fig. B.9.: Lithic clasts of Enkingen (22.6 - 59.3 m).

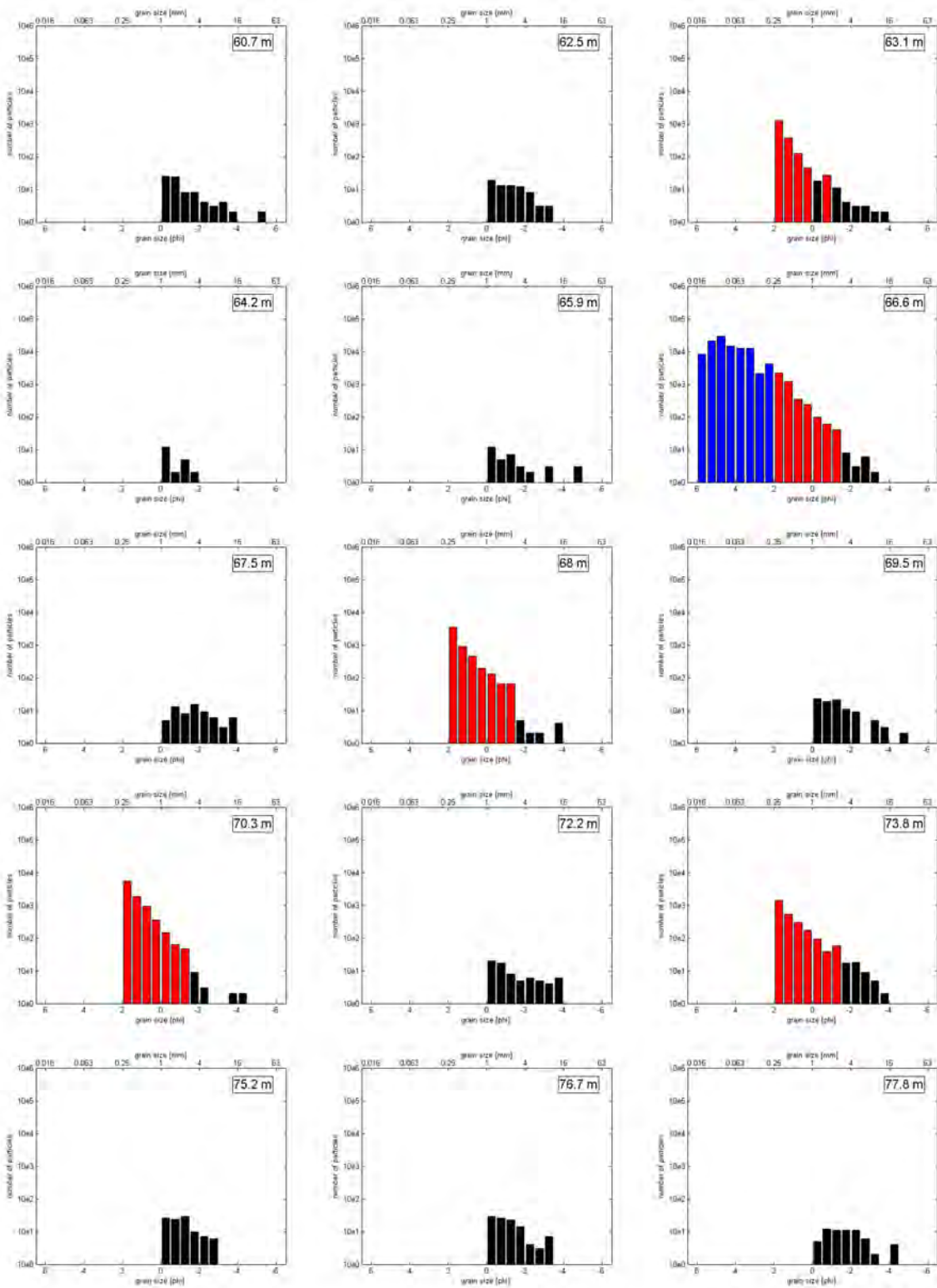


Fig. B.10.: Lithic clasts of Enkingen (60.7 - 77.8 m).

B. Appendix 2

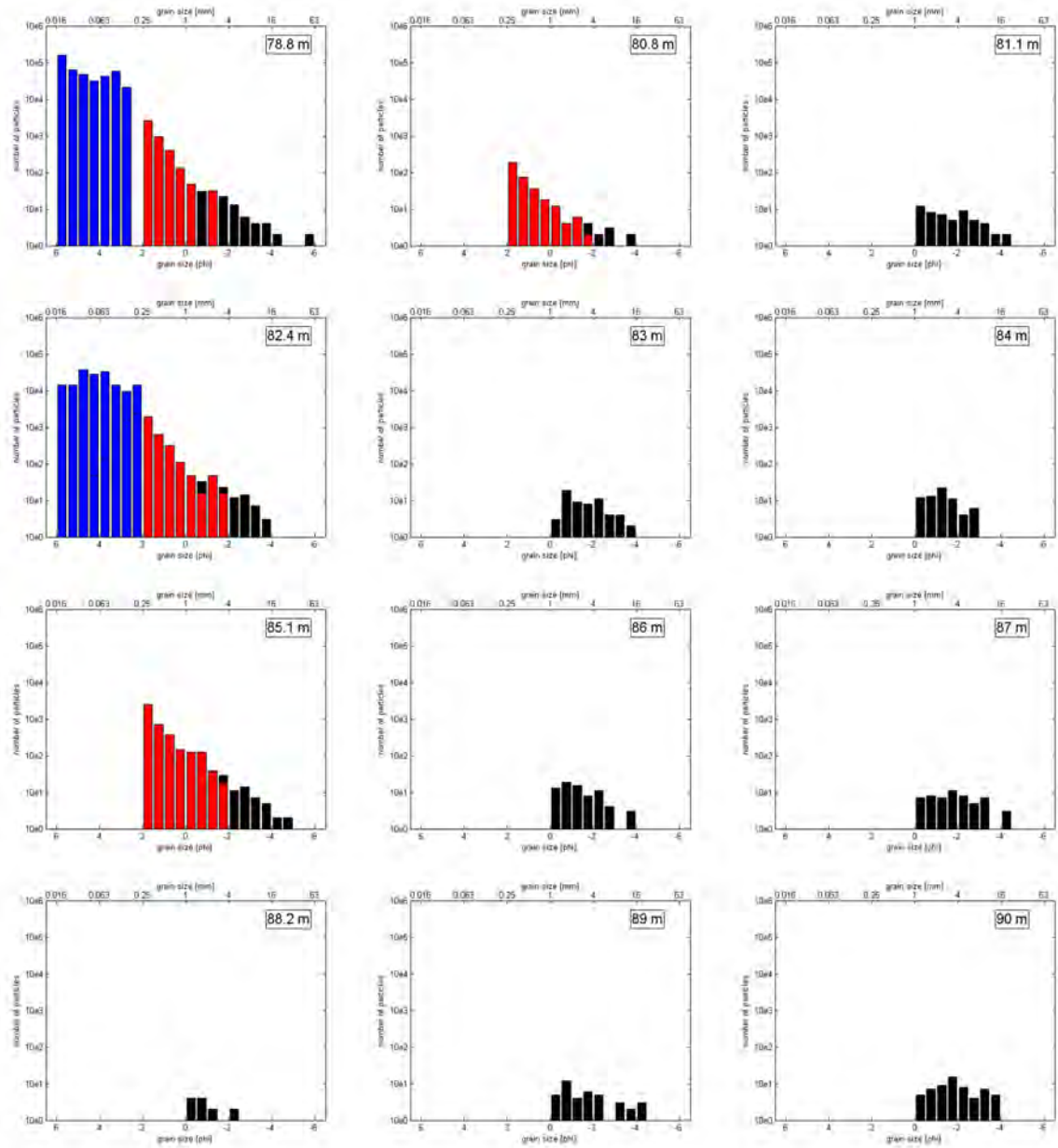


Fig. B.11.: Lithic clasts of Enkingen (78.8 - 90 m).

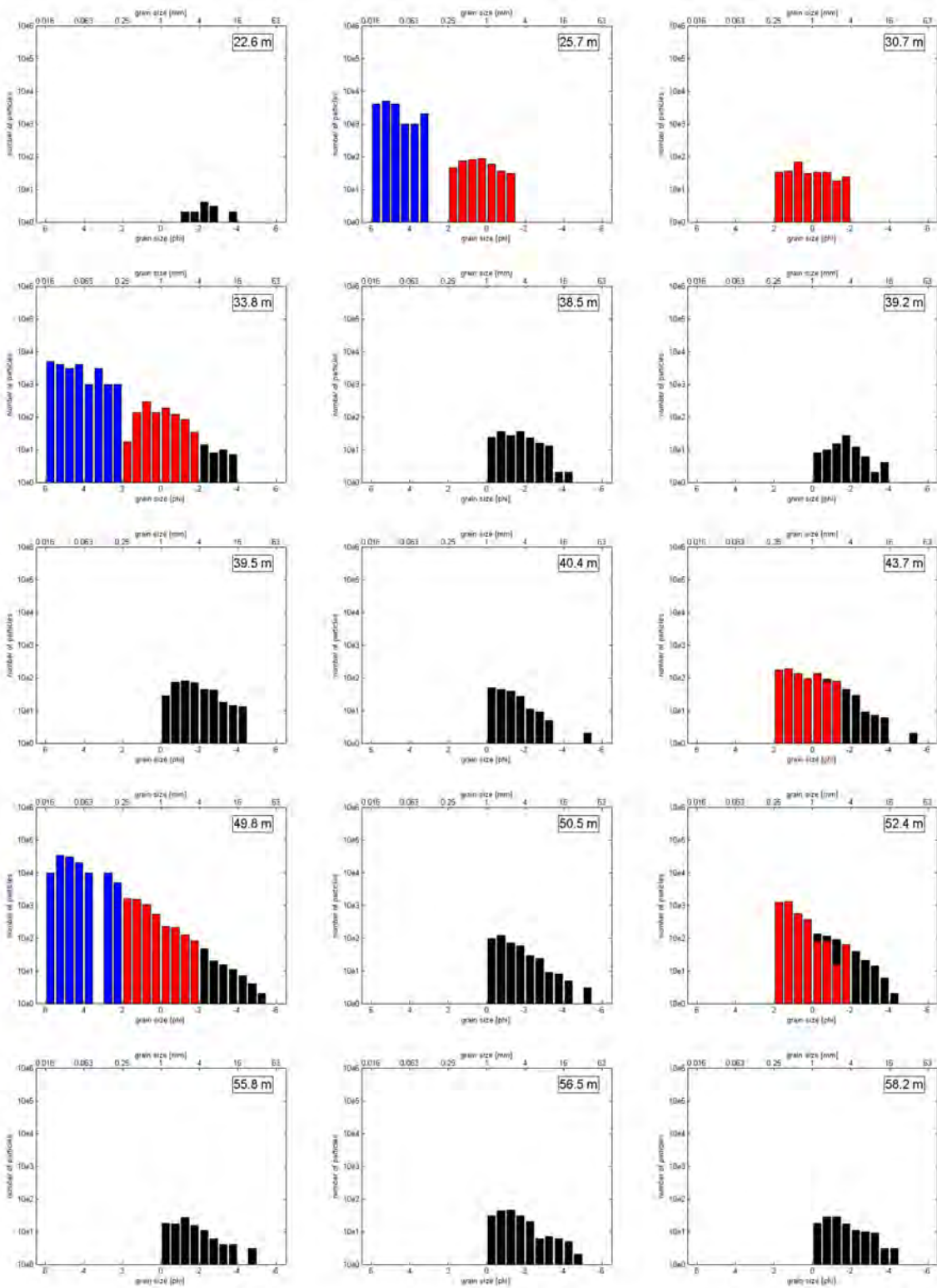


Fig. B.12.: Melt particles of Enkingen (22.6 - 58.2 m).

B. Appendix 2

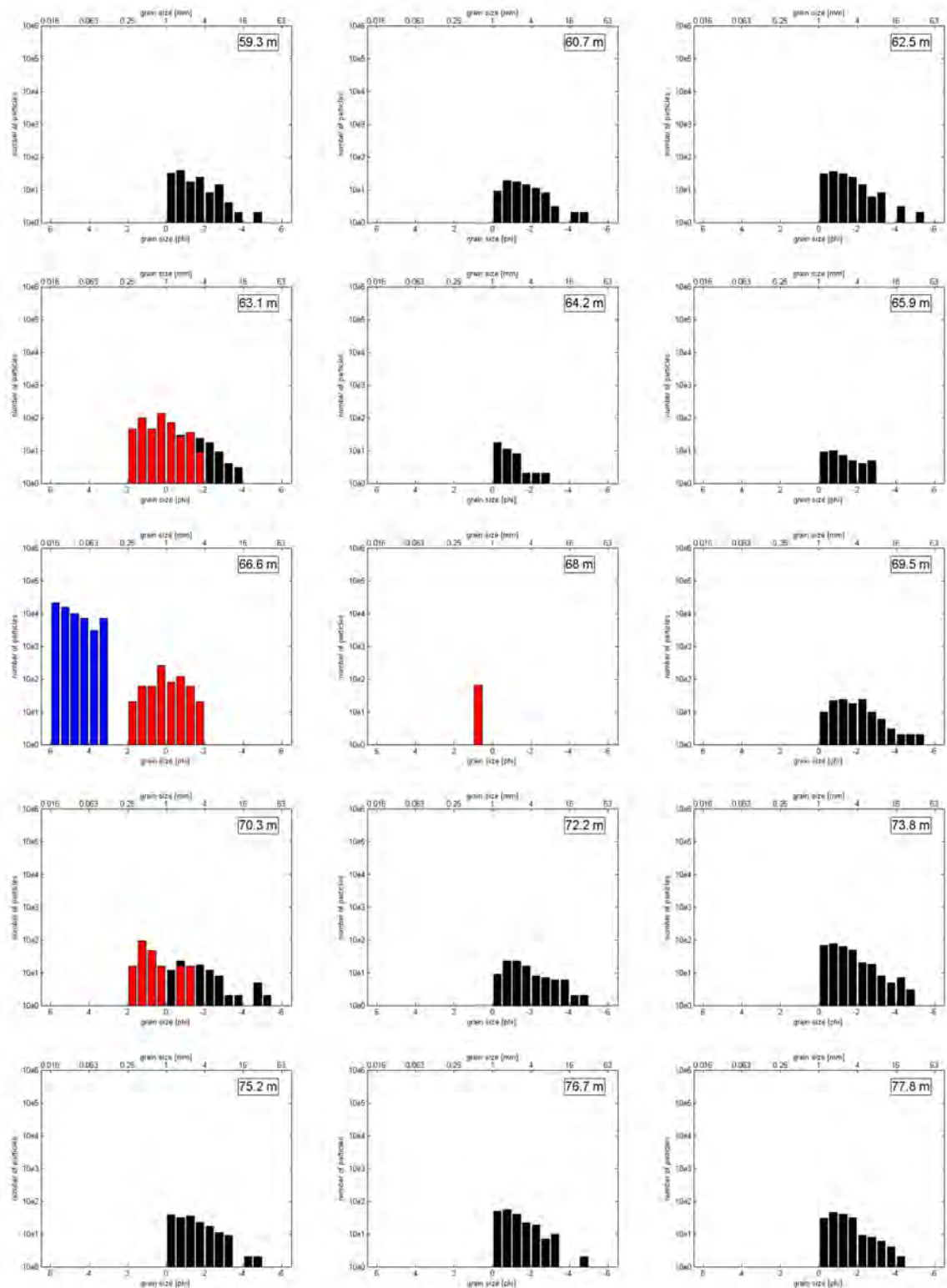


Fig. B.13.: Melt particles of Enkingen (59.3 - 77.8 m).

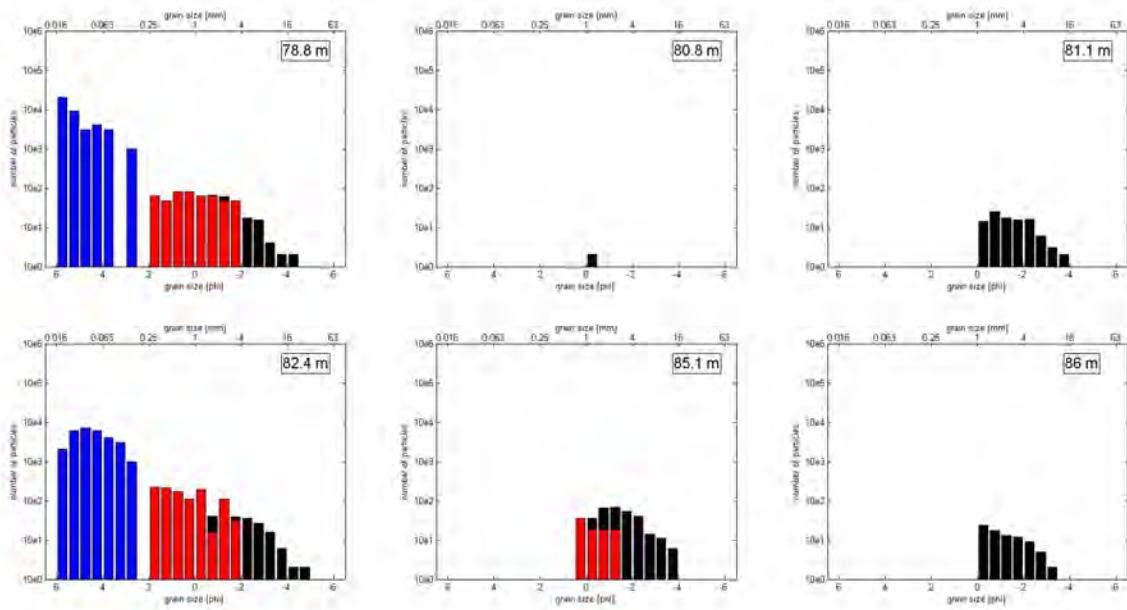


Fig. B.14.: Melt particles of Enkingen (78.8 - 86 m).

B. Appendix 2

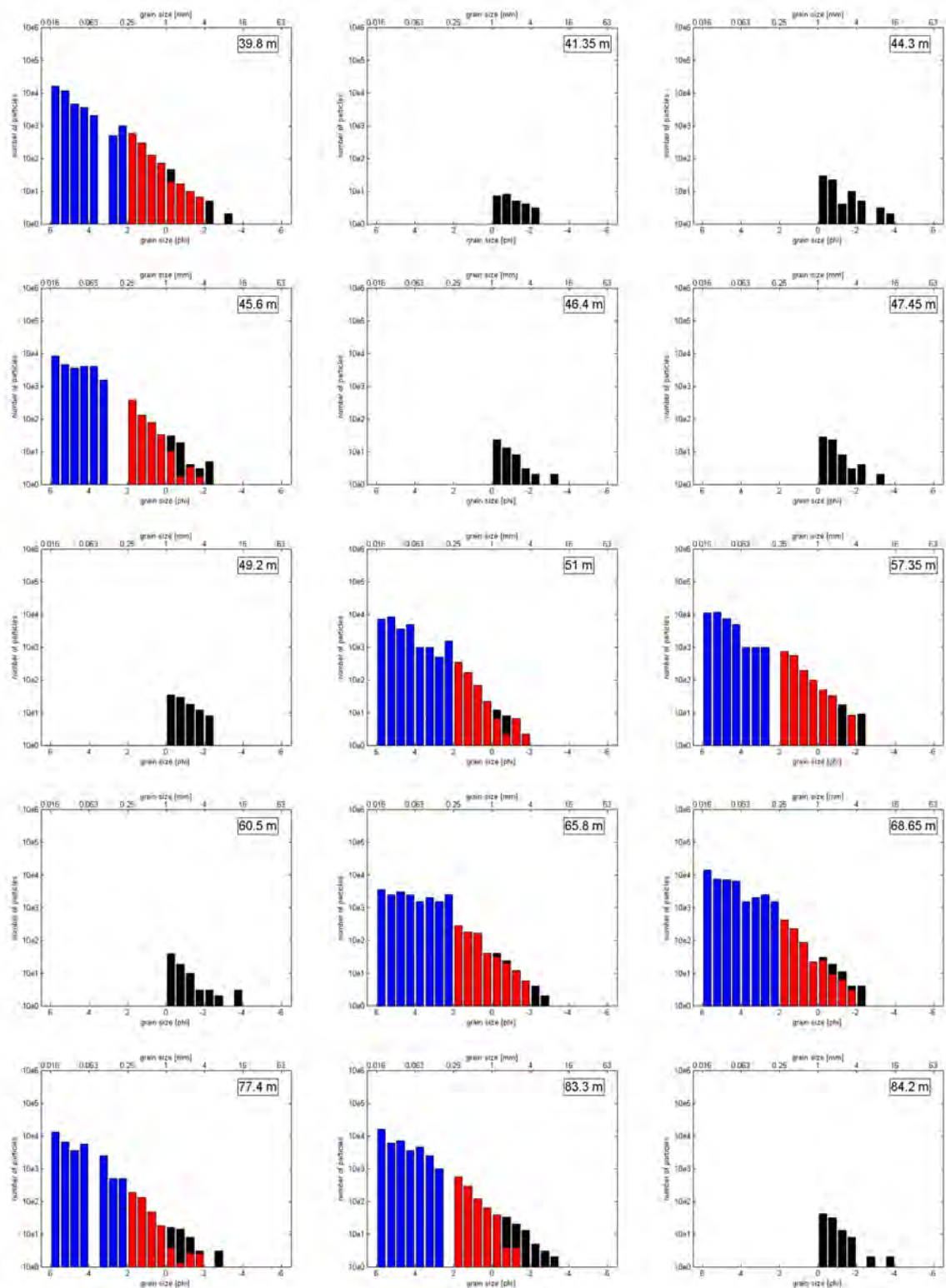


Fig. B.15.: Lithic clasts of Wörnitzostheim (16.4 - 38.9 m).

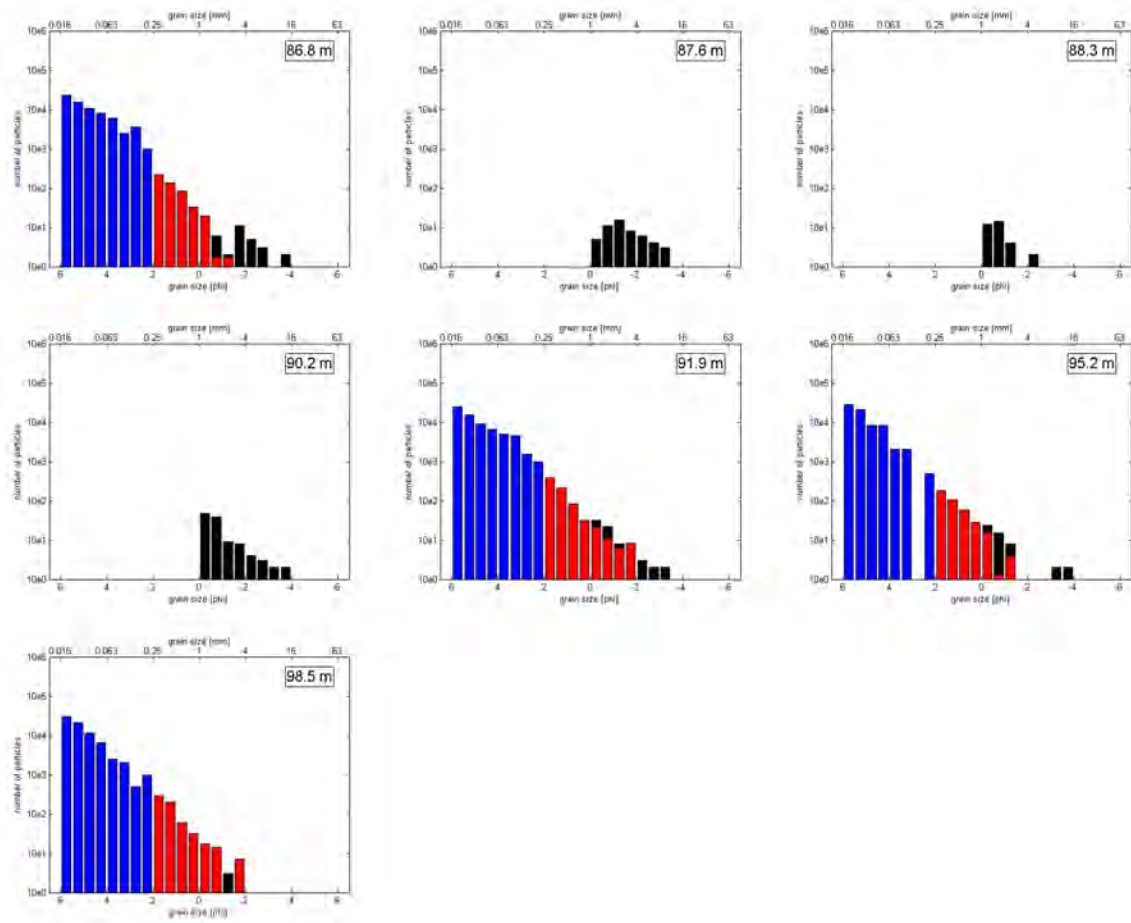


Fig. B.16.: Lithic clasts of Wörnitzostheim (39.8 - 84.2 m).

B. Appendix 2

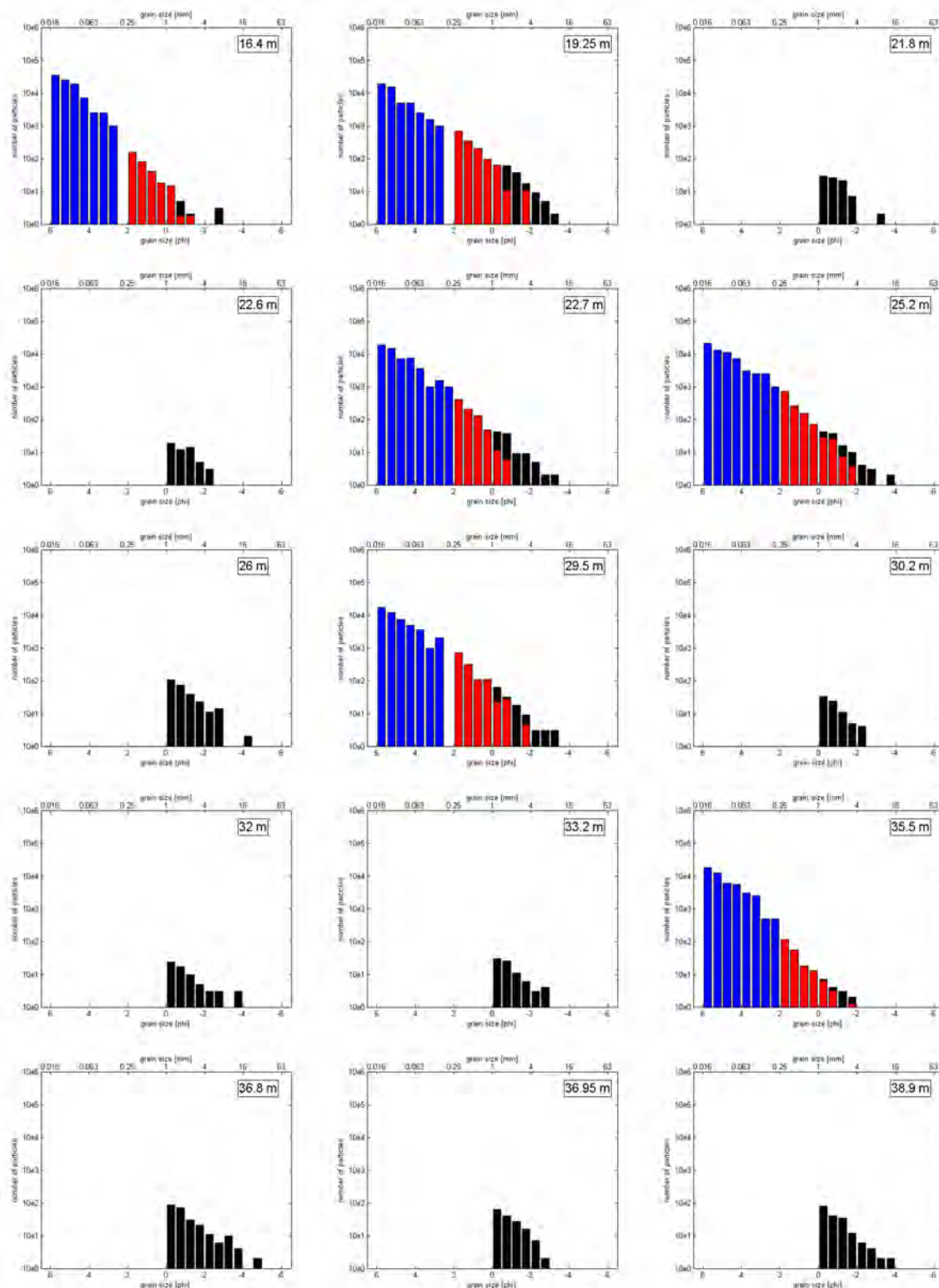


Fig. B.17.: Lithic clasts of Wörnitzostheim (86.8 - 98.5 m).

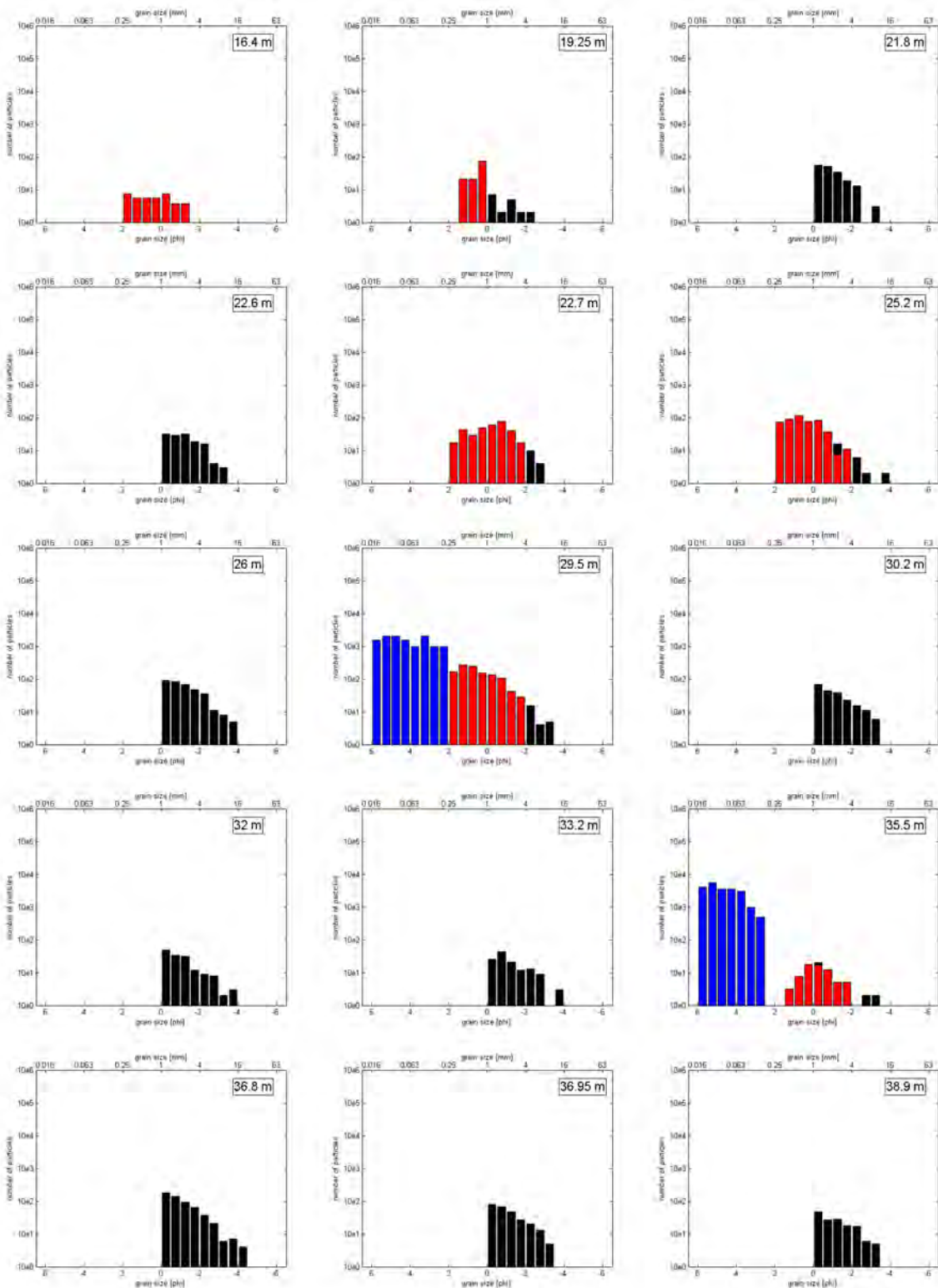


Fig. B.18.: Melt particles of Wörnitzostheim (16.4 - 38.9 m).

B. Appendix 2

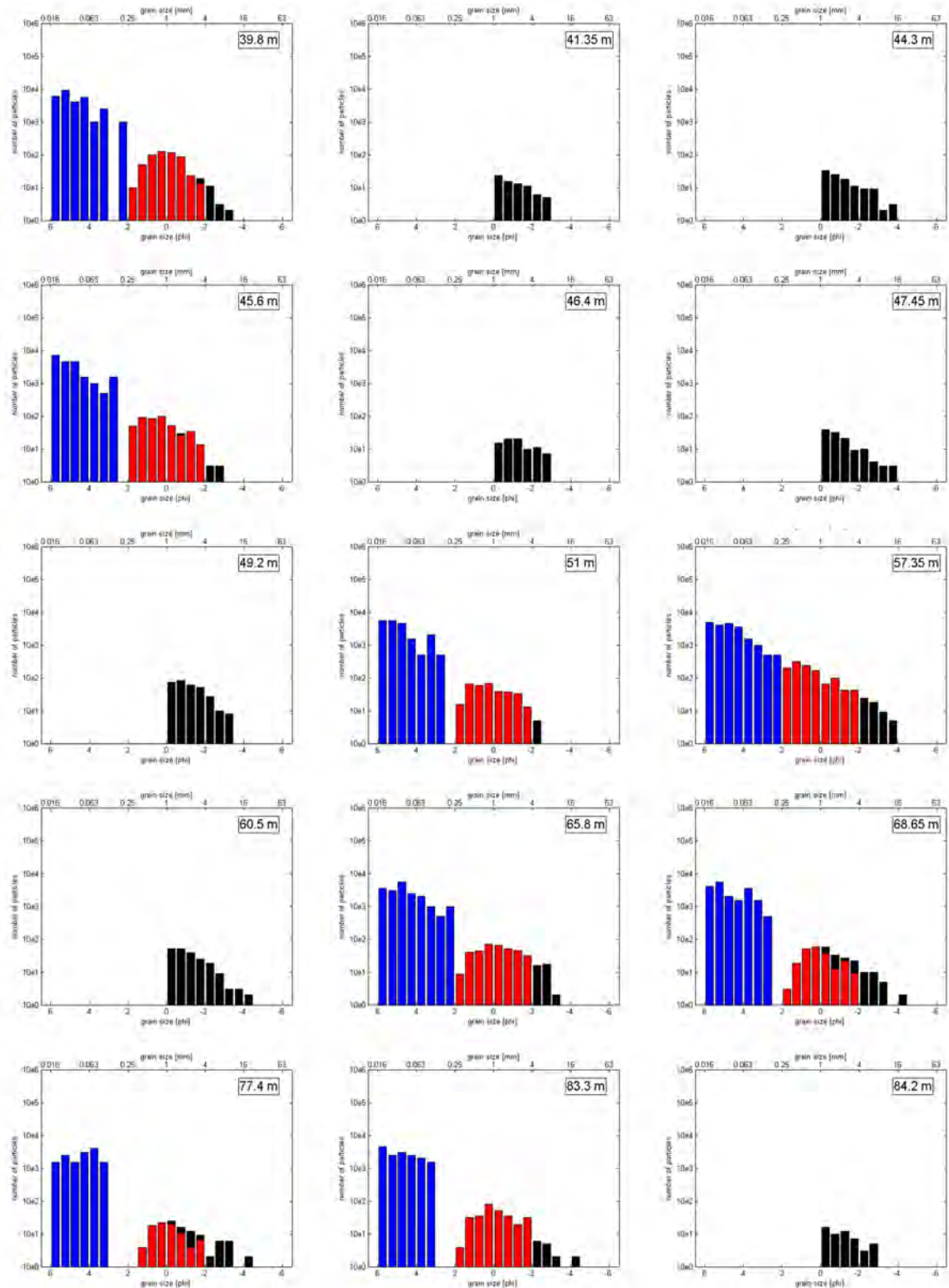


Fig. B.19.: Melt particles of Wörnitzostheim (39.8 - 84.2 m).

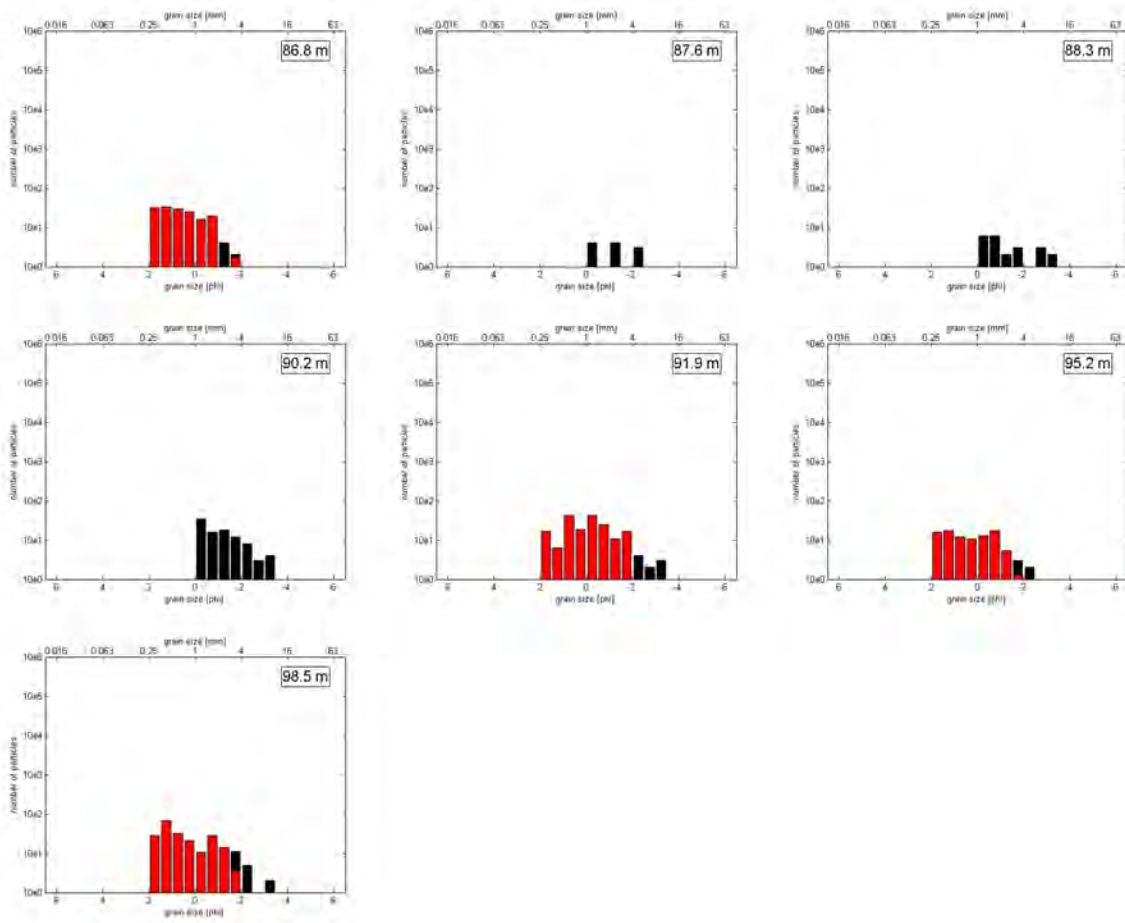


Fig. B.20.: Melt particles of Wörnitzostheim (86.8 - 98.5 m).

B. Appendix 2

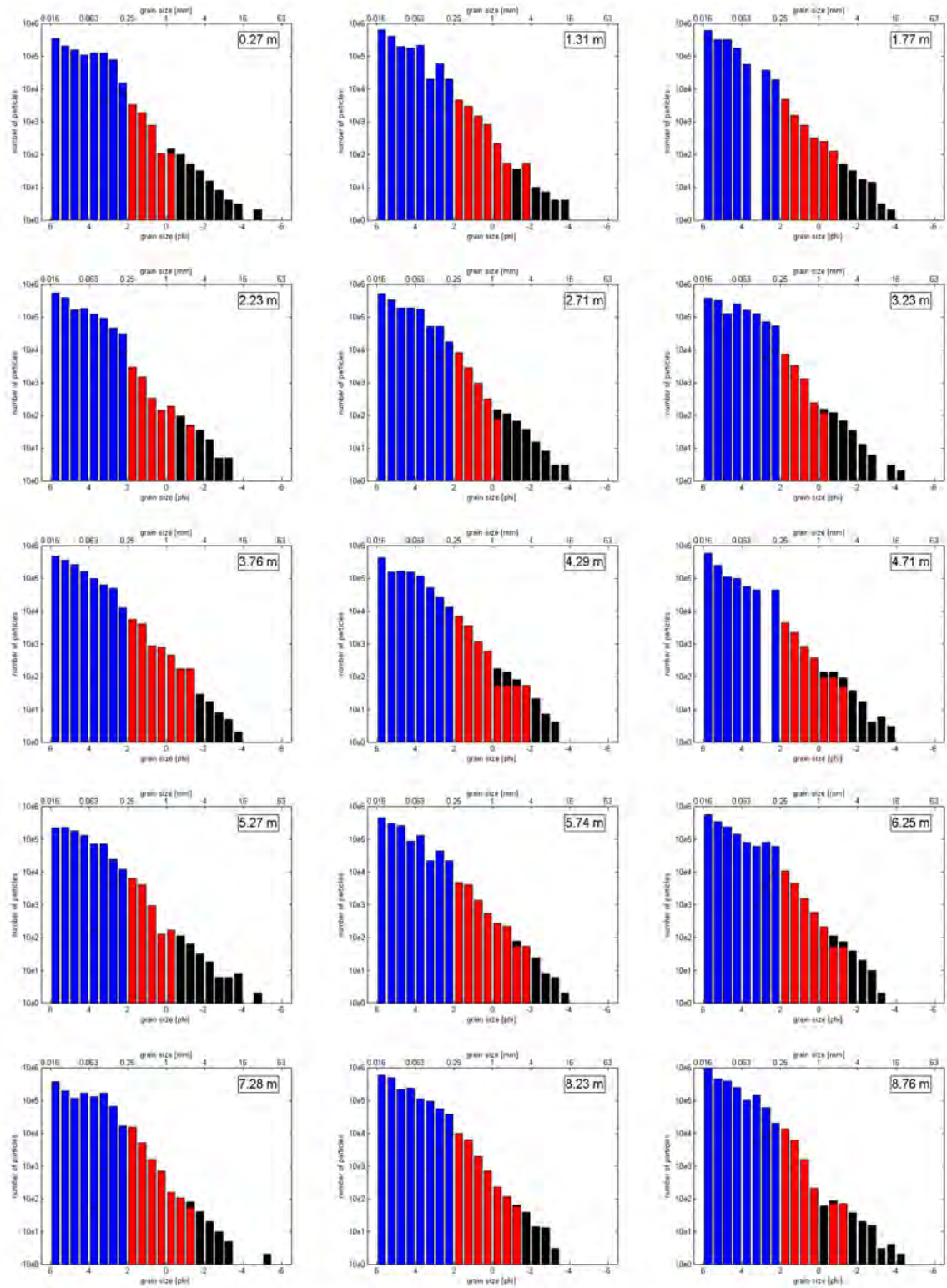


Fig. B.21.: Lithic clasts of Otting (0.27 - 8.76 m).

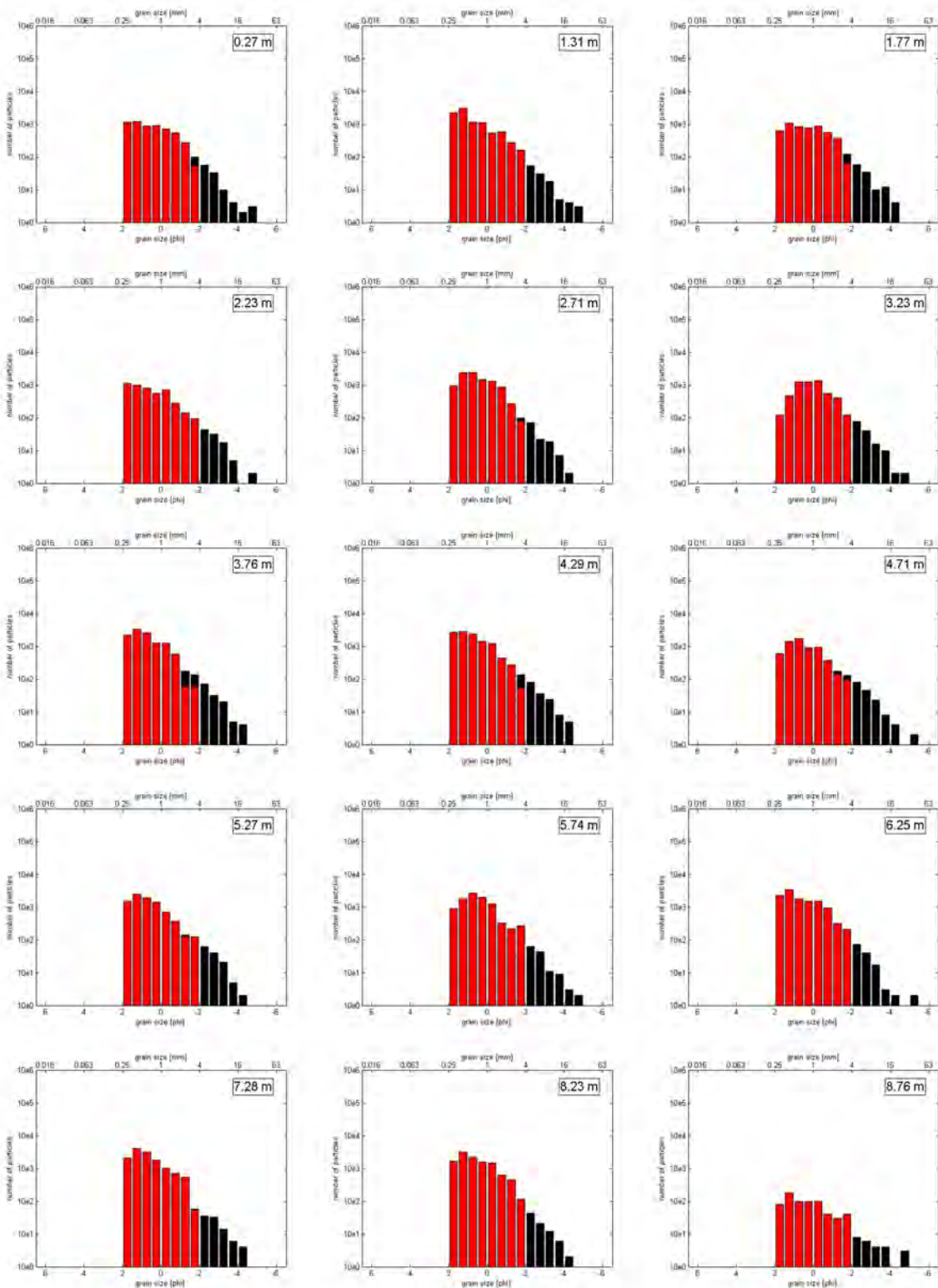


Fig. B.22.: Melt particles of Otting (0.27 - 8.76 m).

C. Appendix 3

Cumulative frequency diagram of grain size distribution of suevite for lithic clasts and melt particles. Right line: from macroscopic analysis with sampling width of 1 to 63 mm, middle line: from thin section analysis with sampling width of 0.1 to 1 mm, right line: from SEM analyses with sampling width of 0.01 to 0.25 mm. $r = \sqrt{(A \cdot B)}$ where A = length of major axis and B = length of minor axis. N_c = number of particles whose sizes are greater than r . D = slope of red line, $-D$ equals “fractal dimension”.

C. Appendix 3

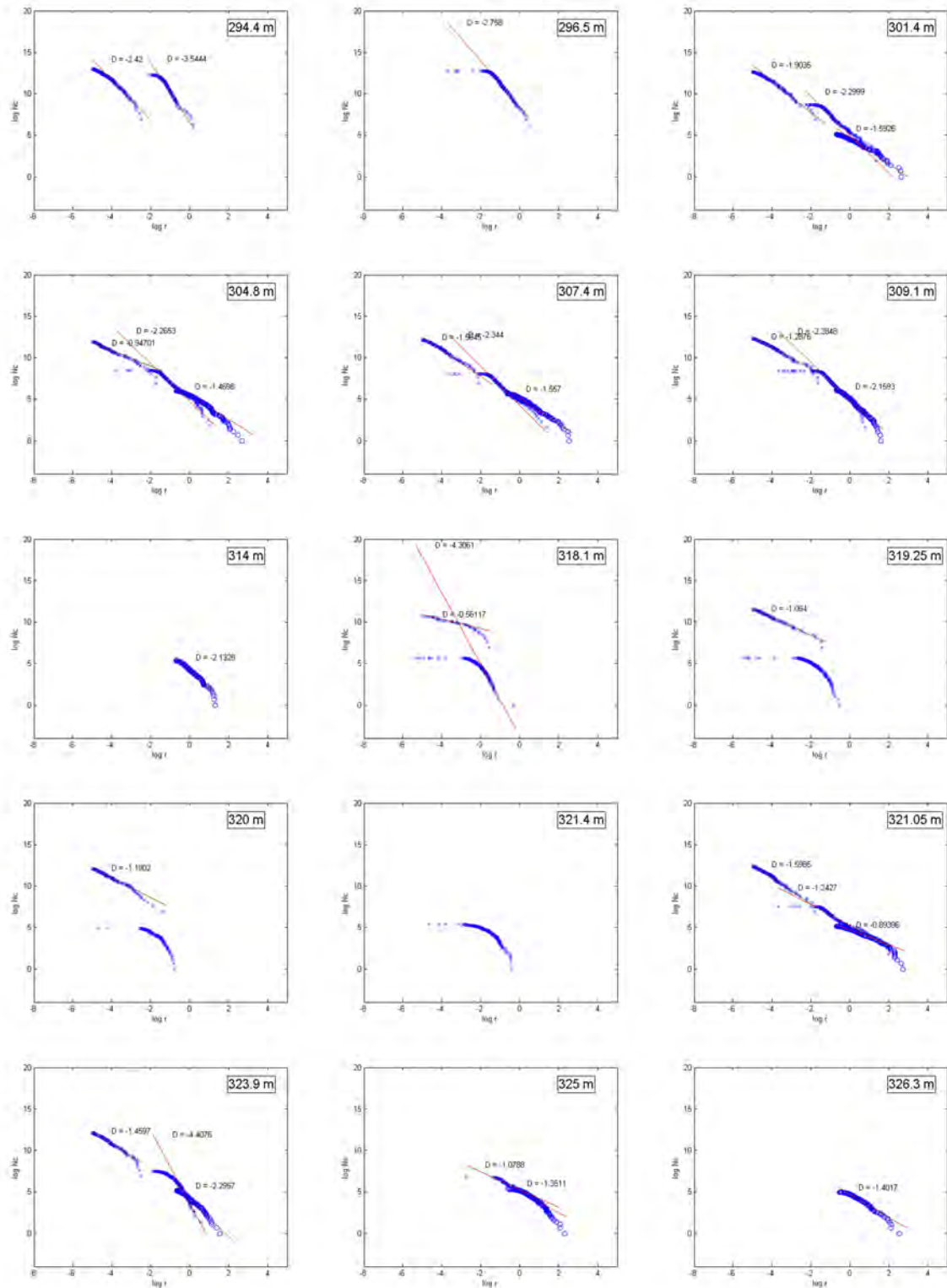


Fig. C.1.: Lithic clasts of FBN73 (294.4 - 326.3 m).

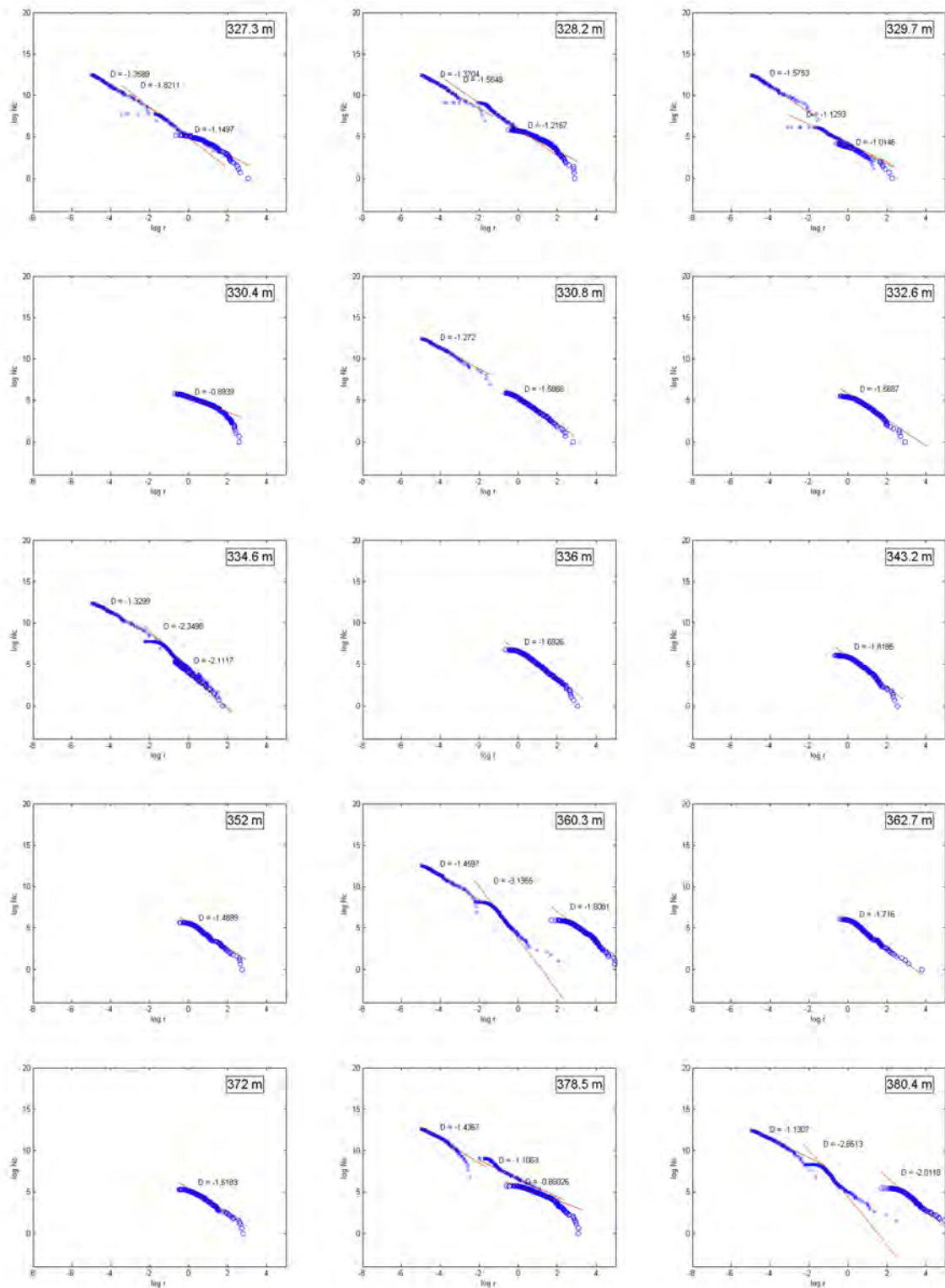


Fig. C.2.: Lithic clasts of FBN73 (327.3 - 380.4 m).

C. Appendix 3

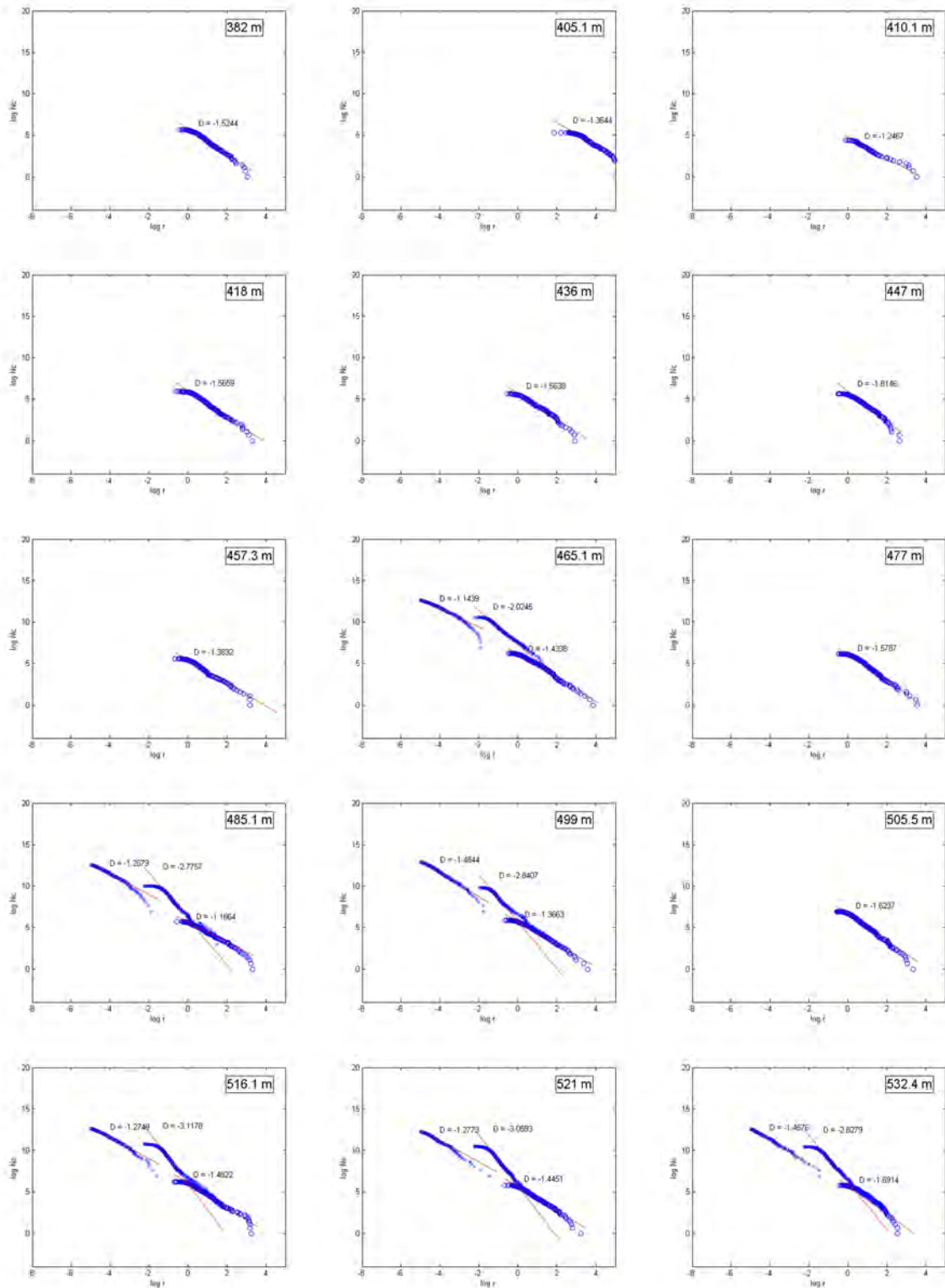


Fig. C.3.: Lithic clasts of FBN73 (382 - 532.4 m).

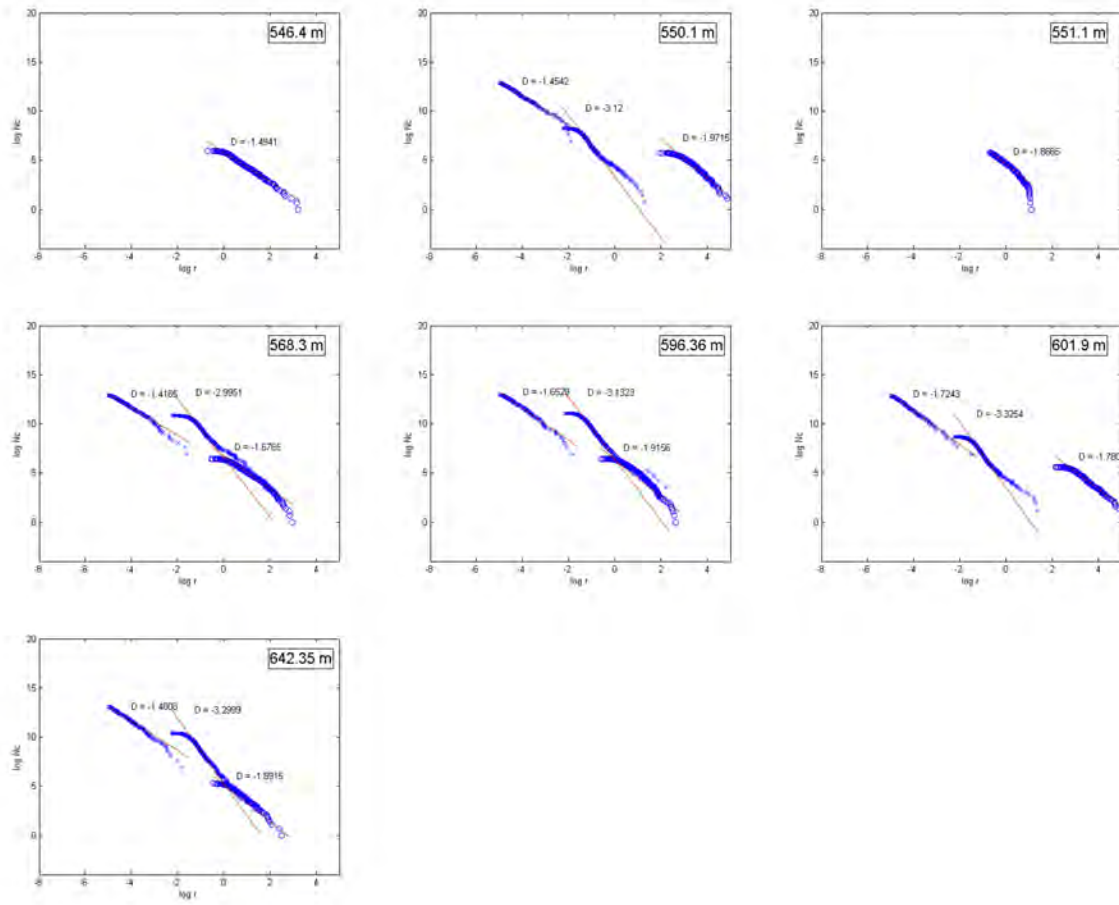


Fig. C.4.: Lithic clasts of FBN73 (546.4 - 642.35 m).

C. Appendix 3

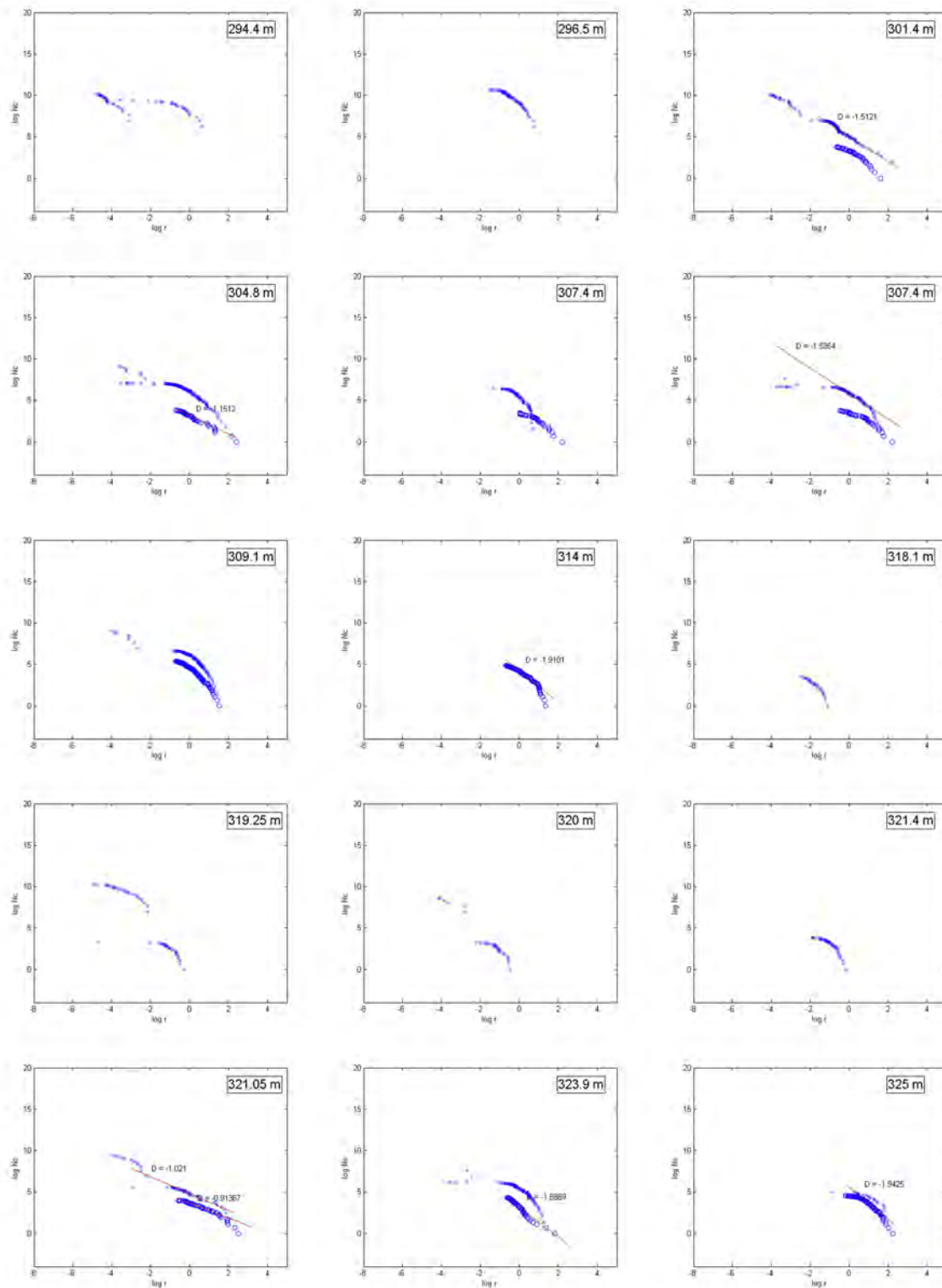


Fig. C.5.: Melt particles of FBN73 (294.4 - 325 m).

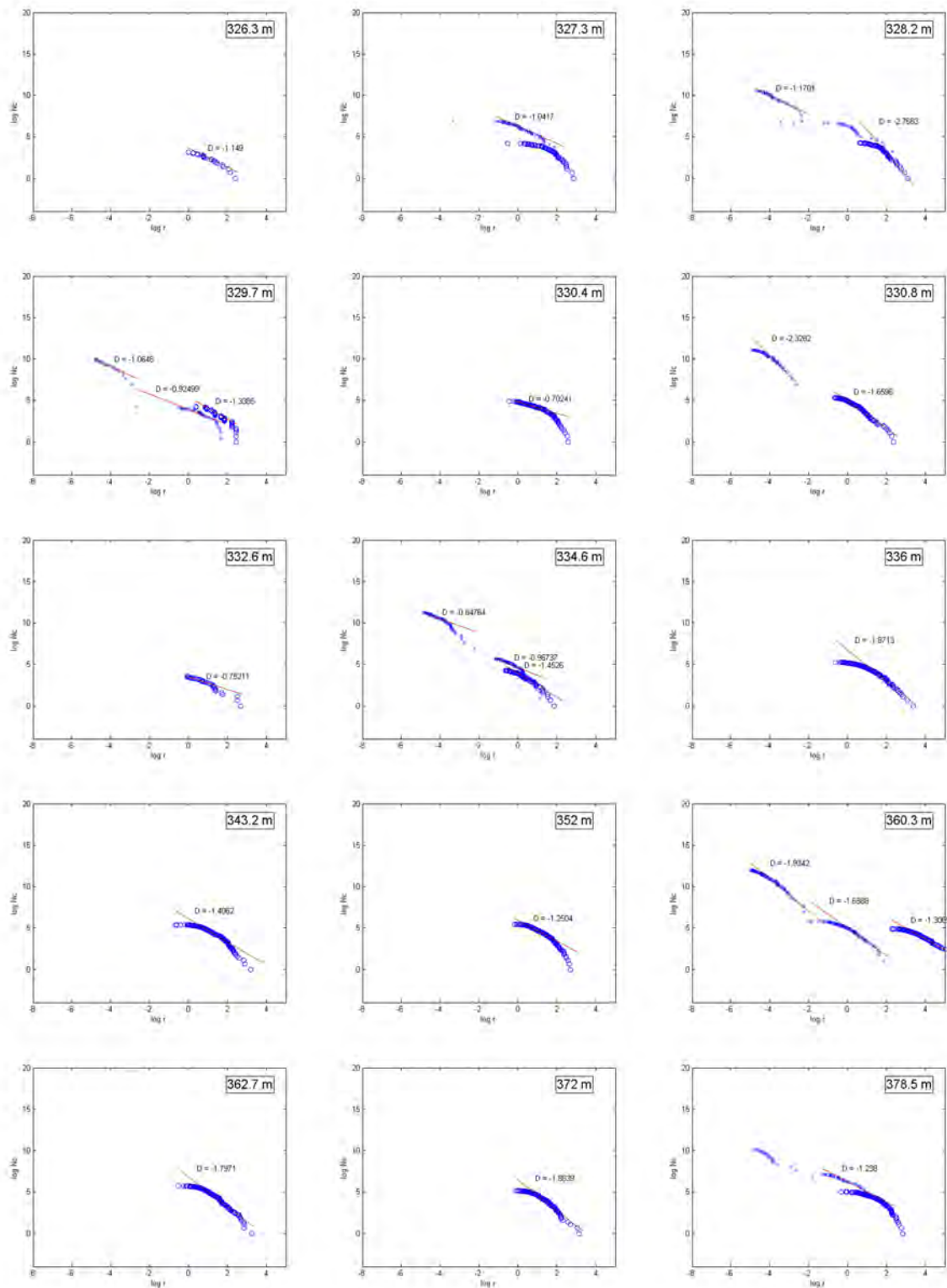


Fig. C.6.: Melt particles of FBN73 (326.3 - 378.5 m).

C. Appendix 3

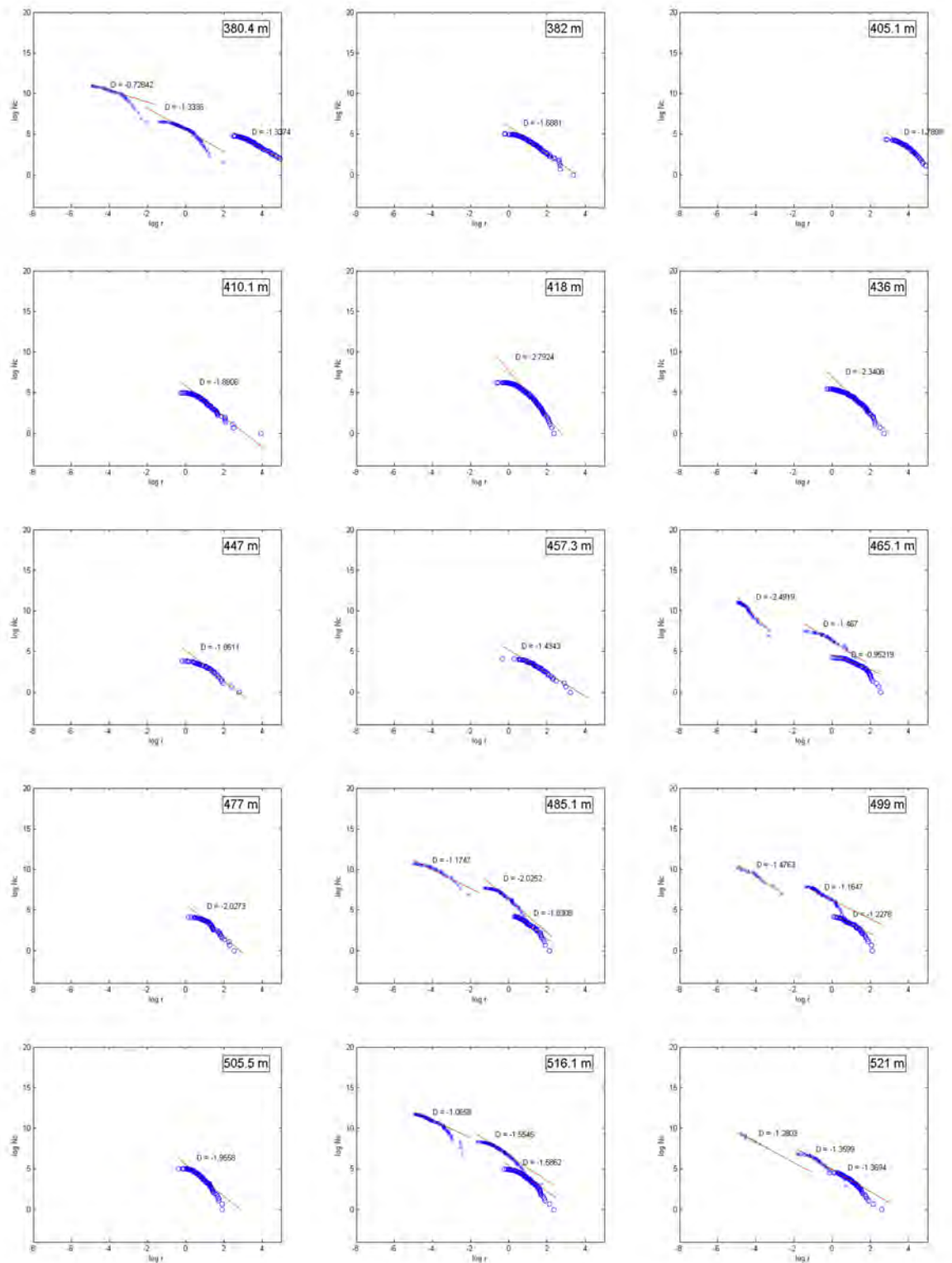


Fig. C.7.: Melt particles of FBN73 (380.4 - 521 m).

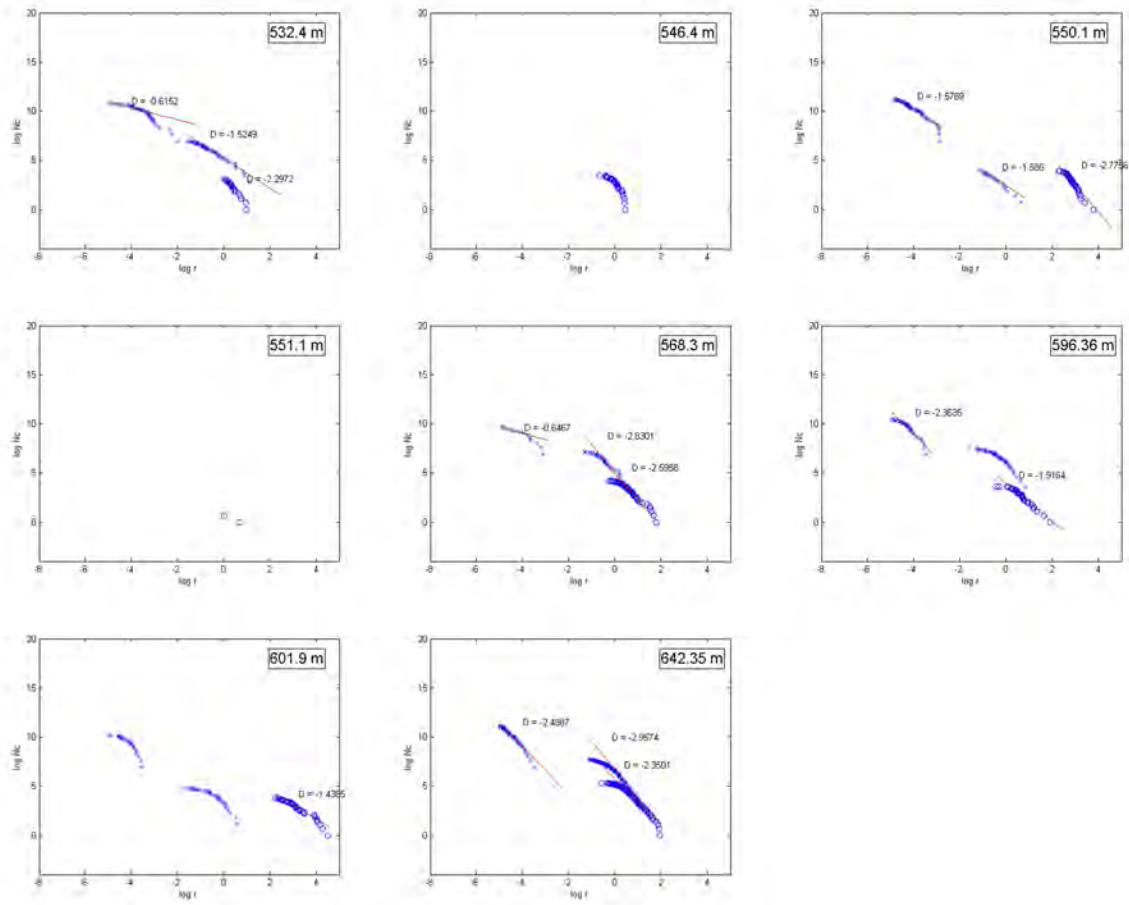


Fig. C.8.: Melt particles of FBN73 (532.4 - 642.35 m).

C. Appendix 3

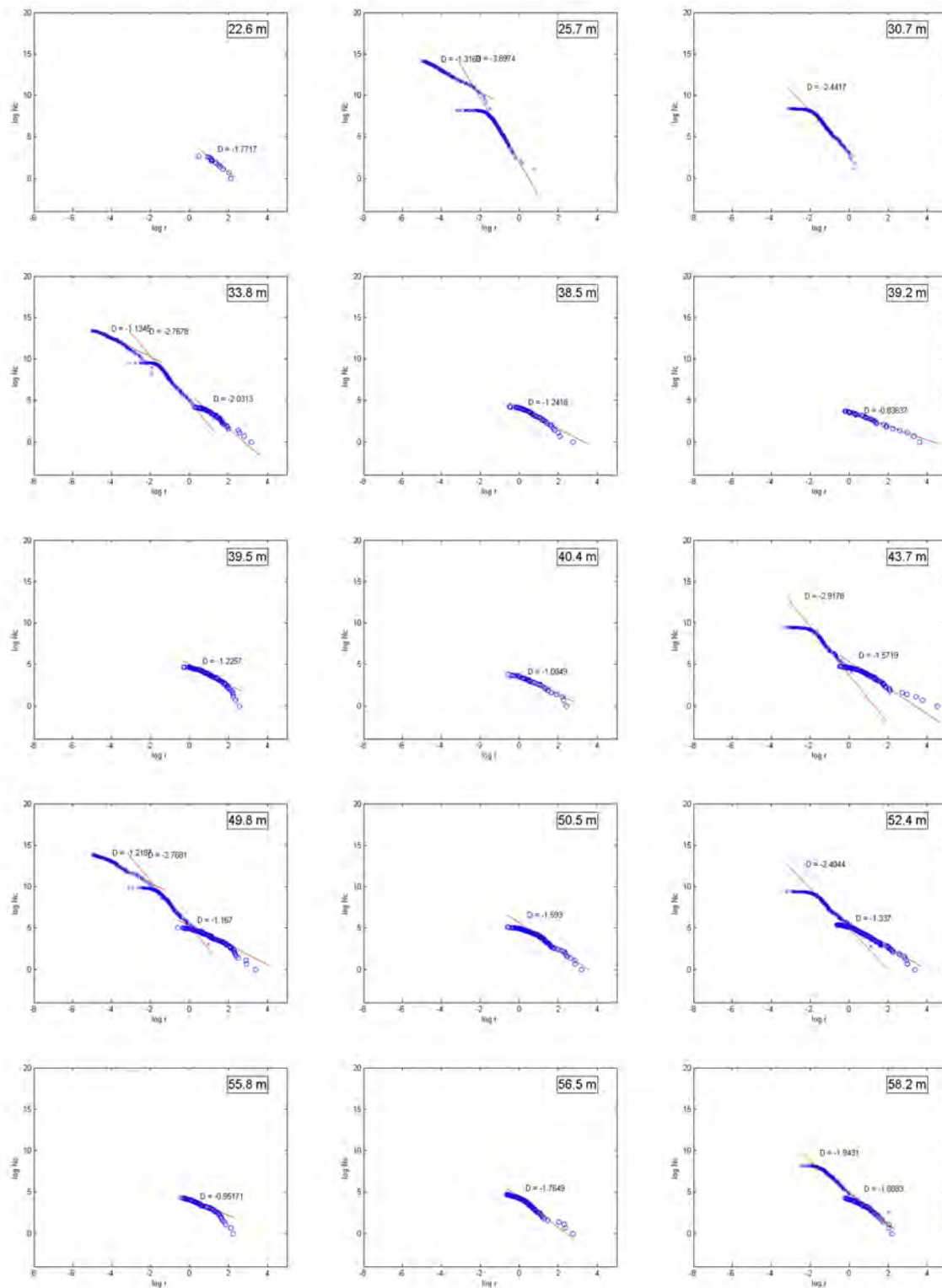


Fig. C.9.: Lithic clasts of Enkingen (22.6 - 58.2 m).

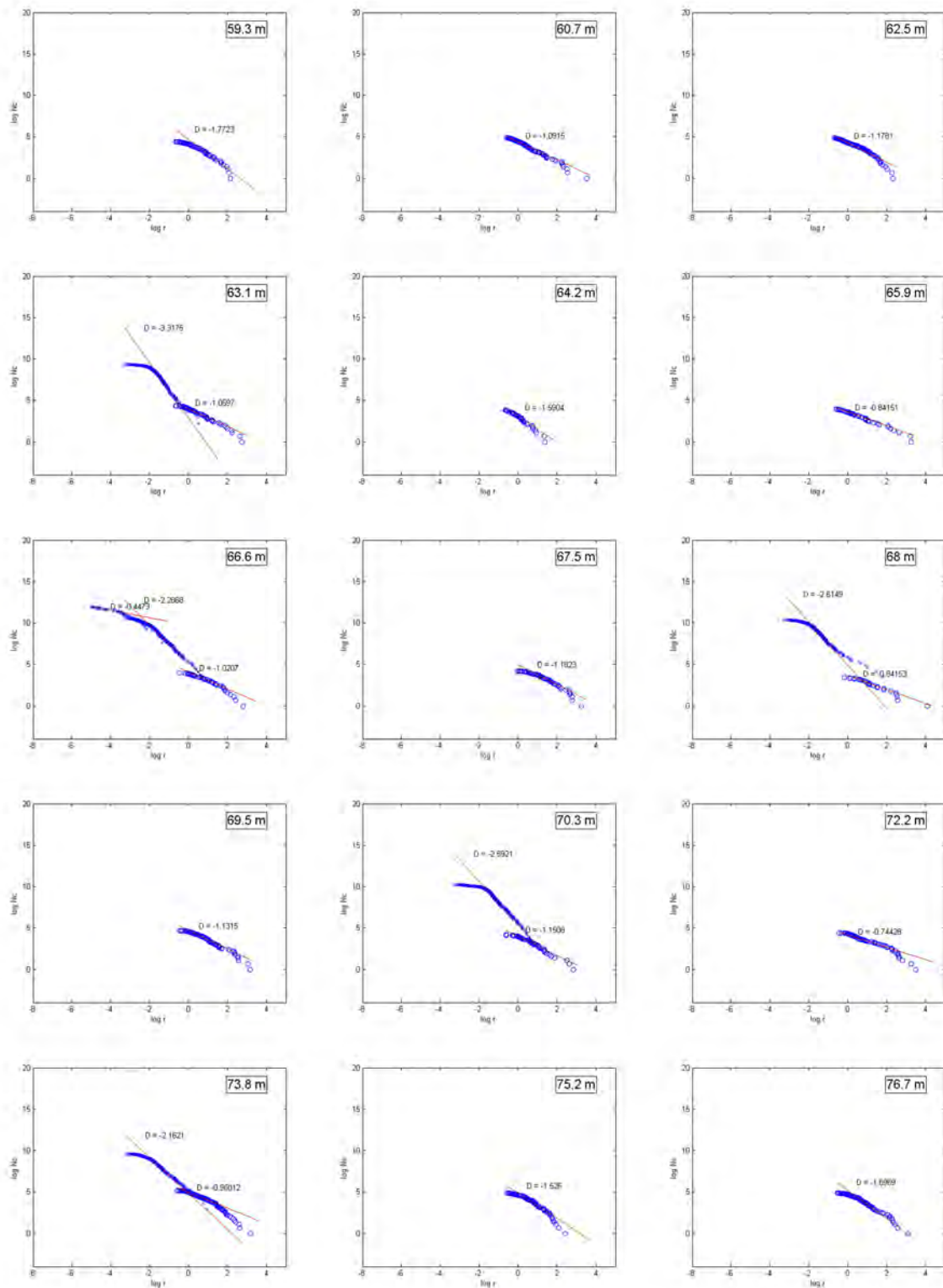


Fig. C.10.: Lithic clasts of Enkingen (59.3 - 76.7 m).

C. Appendix 3

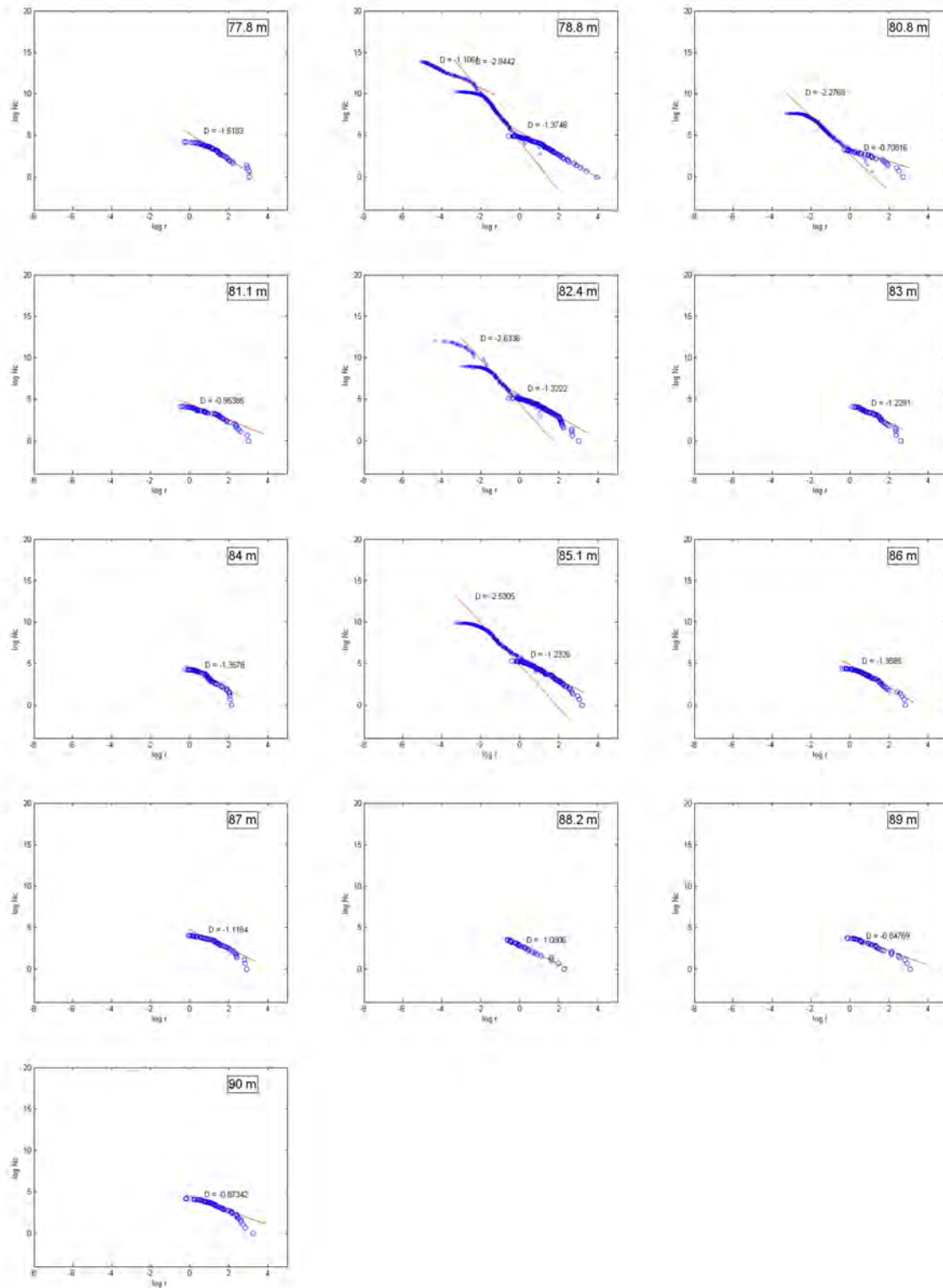


Fig. C.11.: Lithic clasts of Enkingen (77.8 - 90 m).

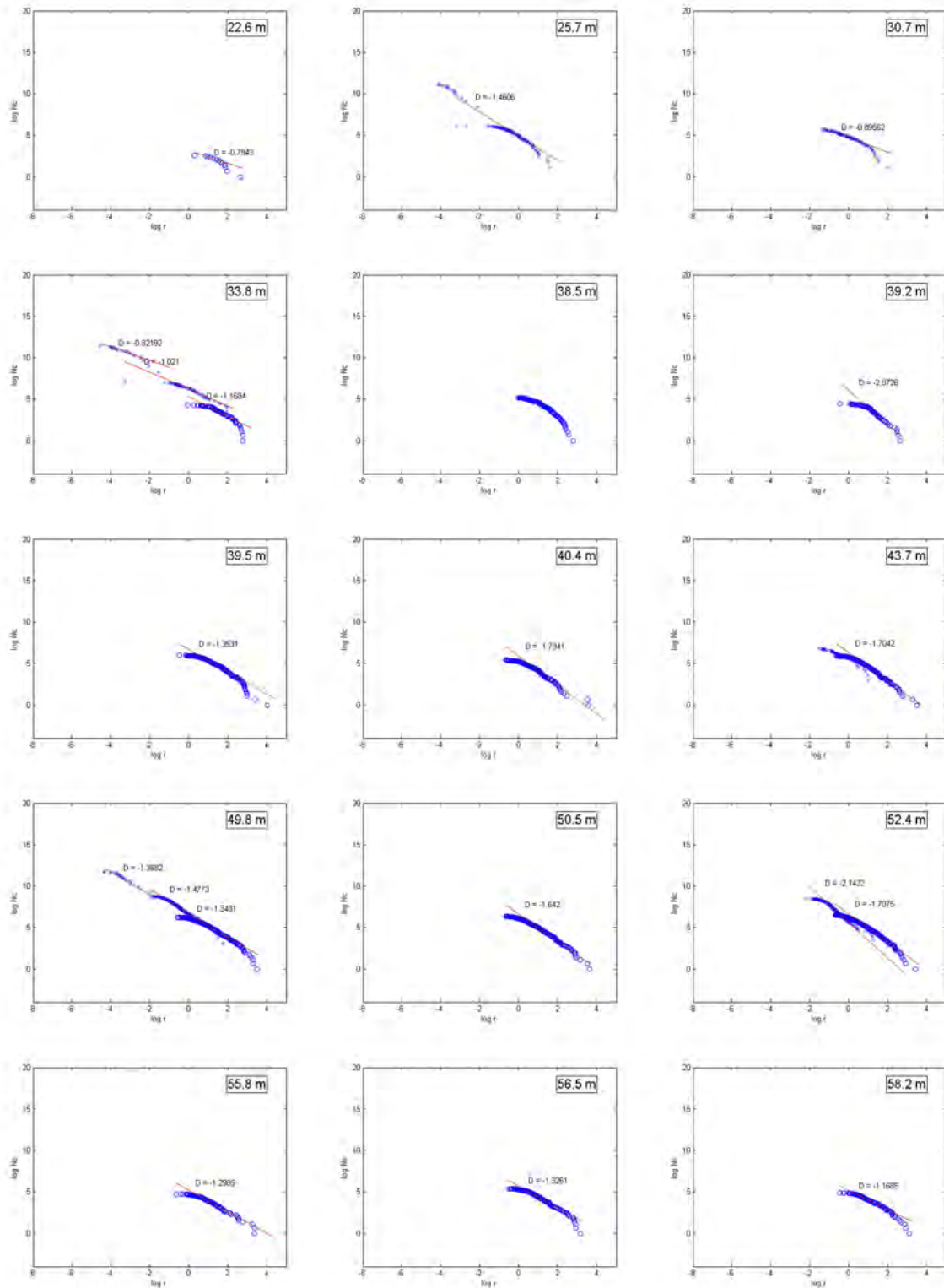


Fig. C.12.: Melt particles of Enkingen (22.6 - 58.2 m).

C. Appendix 3

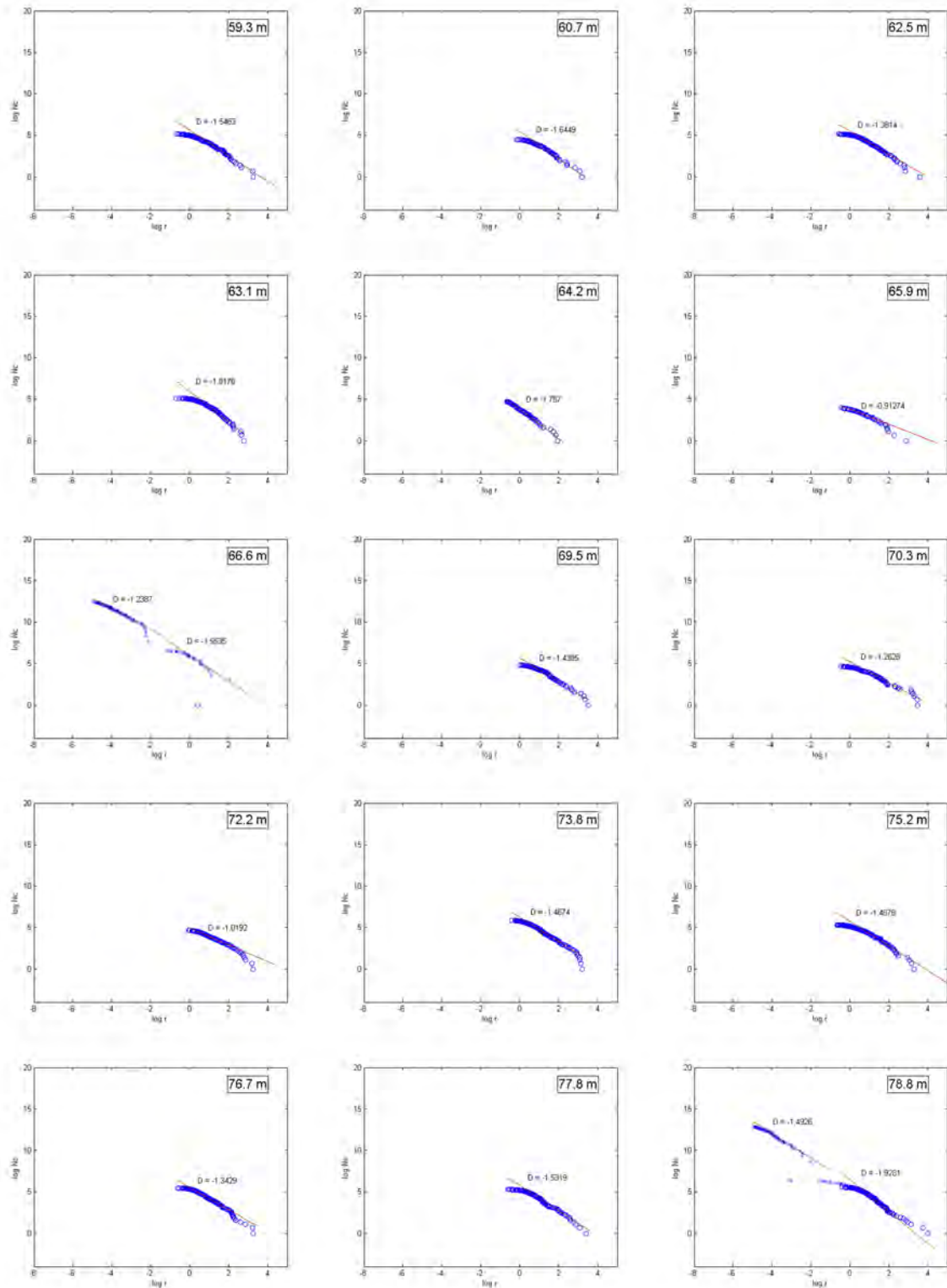


Fig. C.13.: Melt particles of Enkingen (59.3 - 78.8 m).

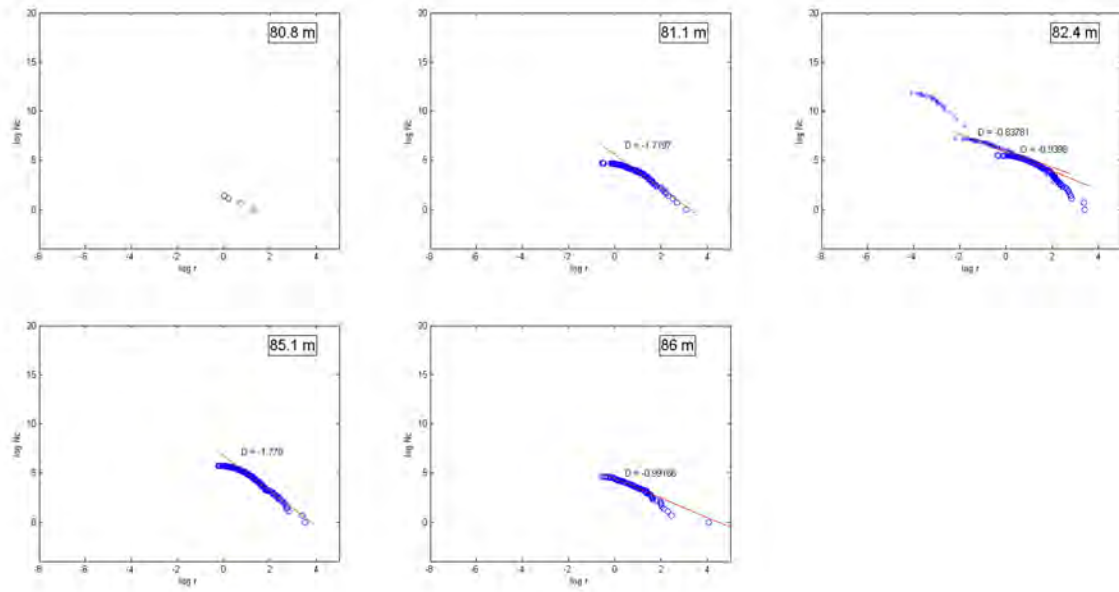


Fig. C.14.: Melt particles of Enkingen (80.8 - 86 m).

C. Appendix 3

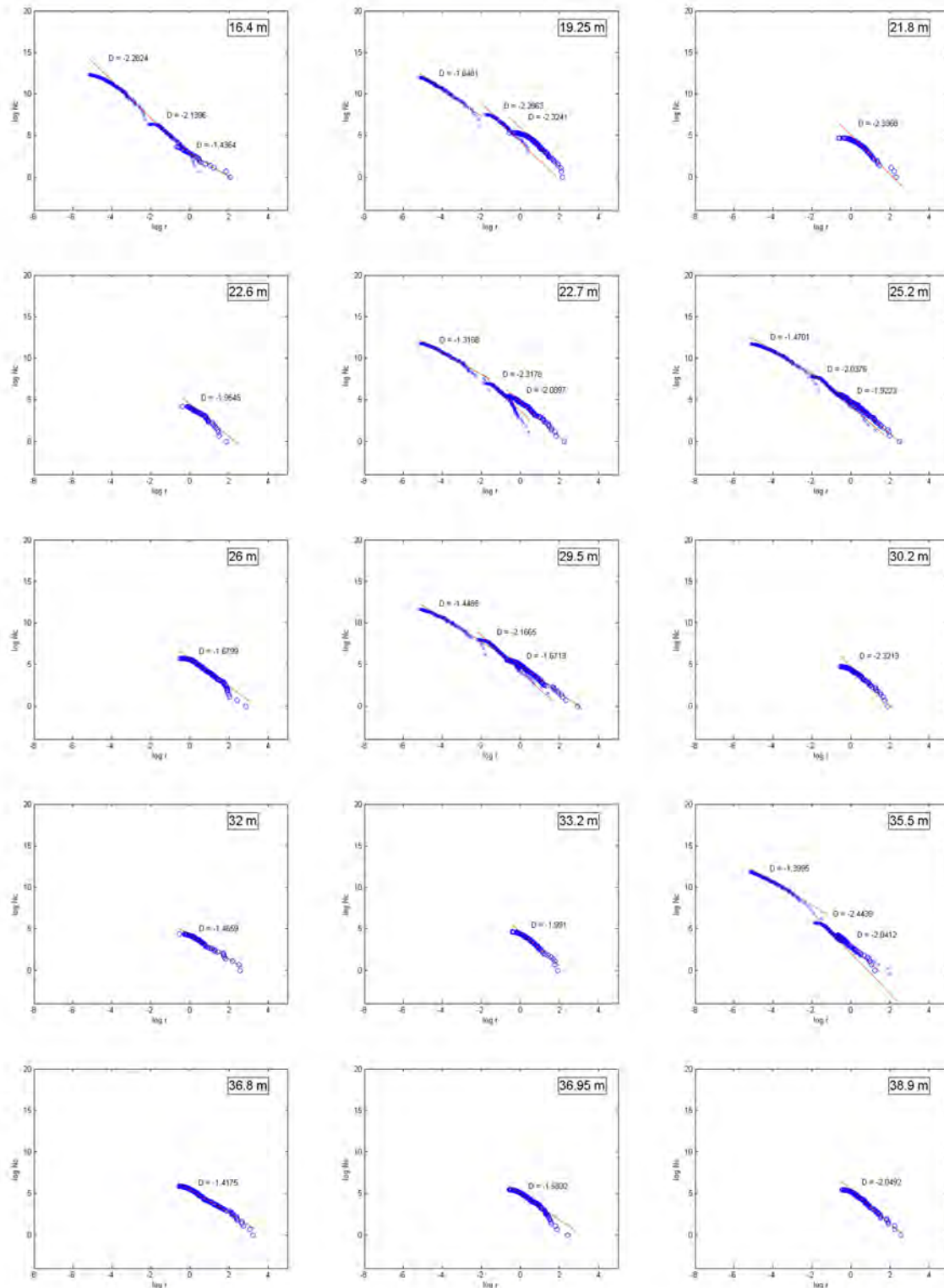


Fig. C.15.: Lithic clasts of Wörlitzostheim (16.4 - 38.9 m).

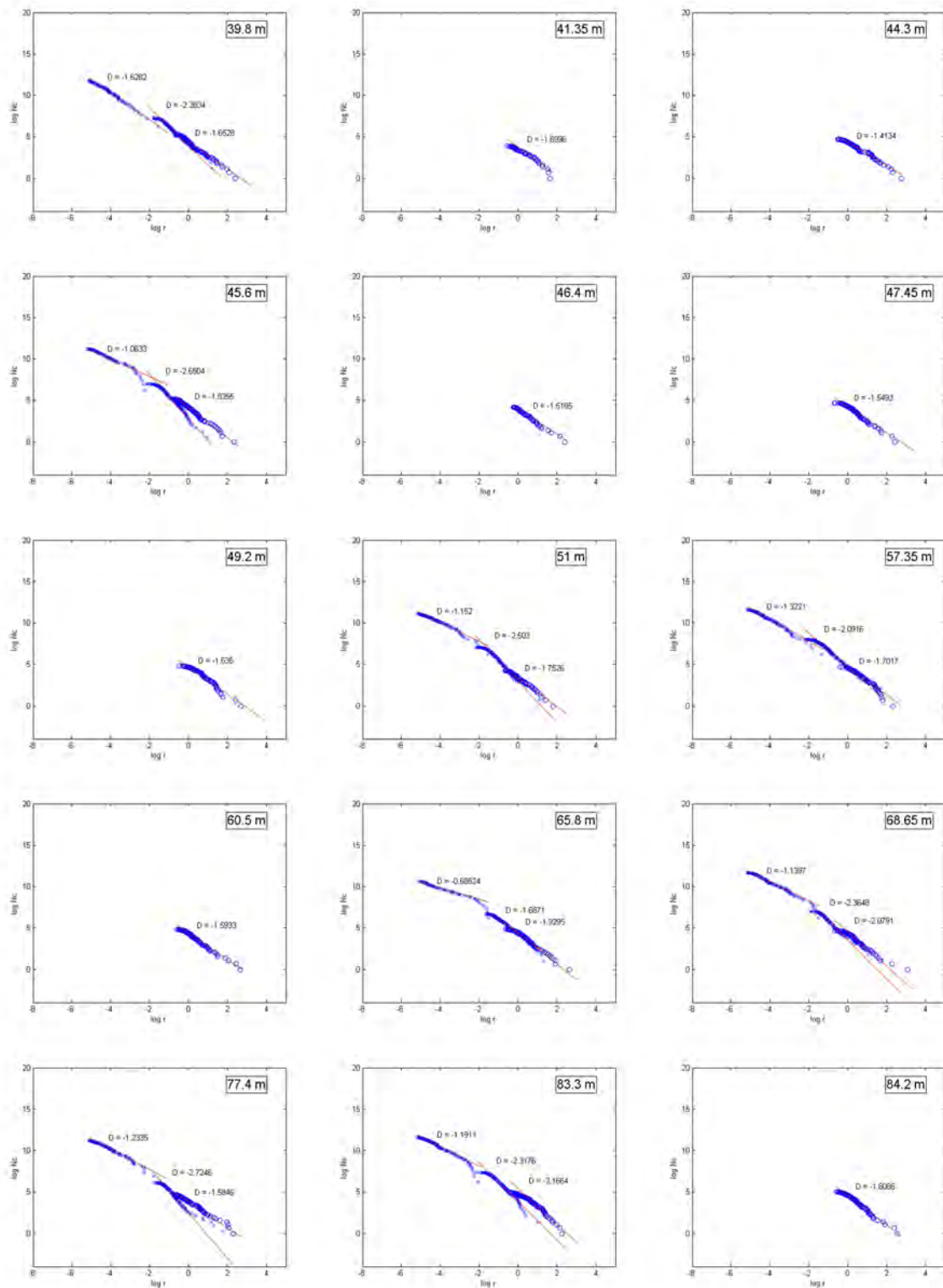


Fig. C.16.: Lithic clasts of Wörnitzostheim (39.8 - 84.2 m).

C. Appendix 3

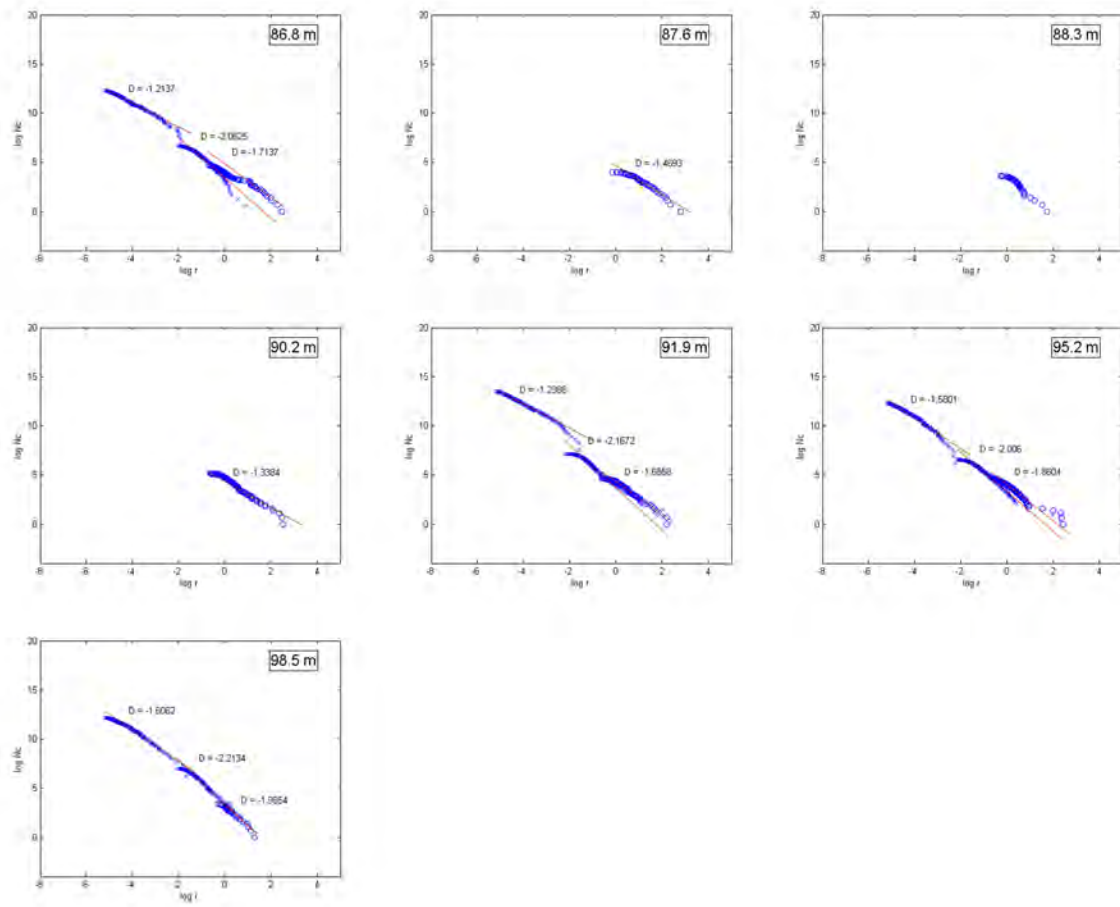


Fig. C.17.: Lithic clasts of Wörnitzostheim (86.8 - 98.5 m).

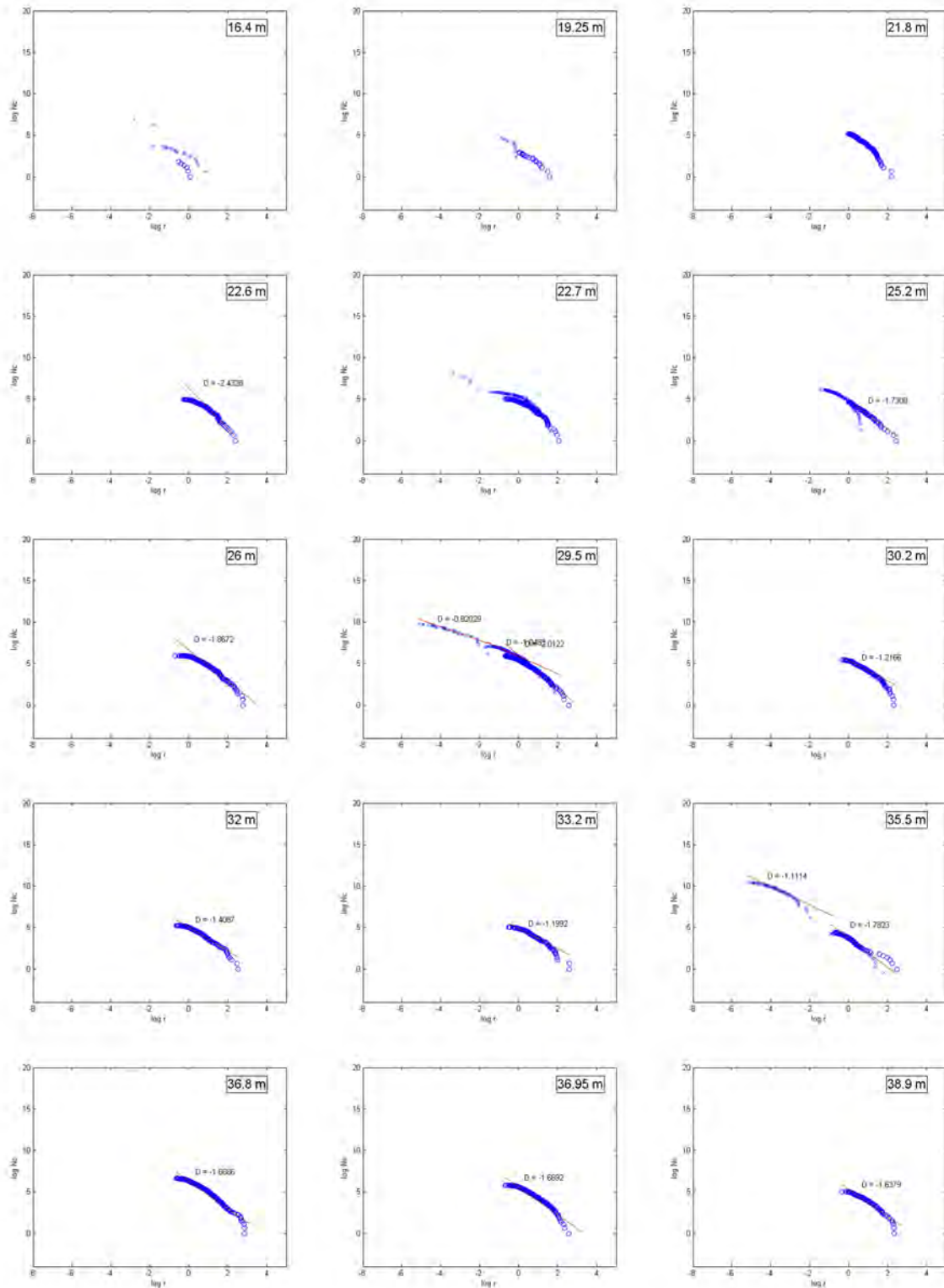


Fig. C.18.: Melt particles of Wörnitzostheim (16.4 - 38.9 m).

C. Appendix 3

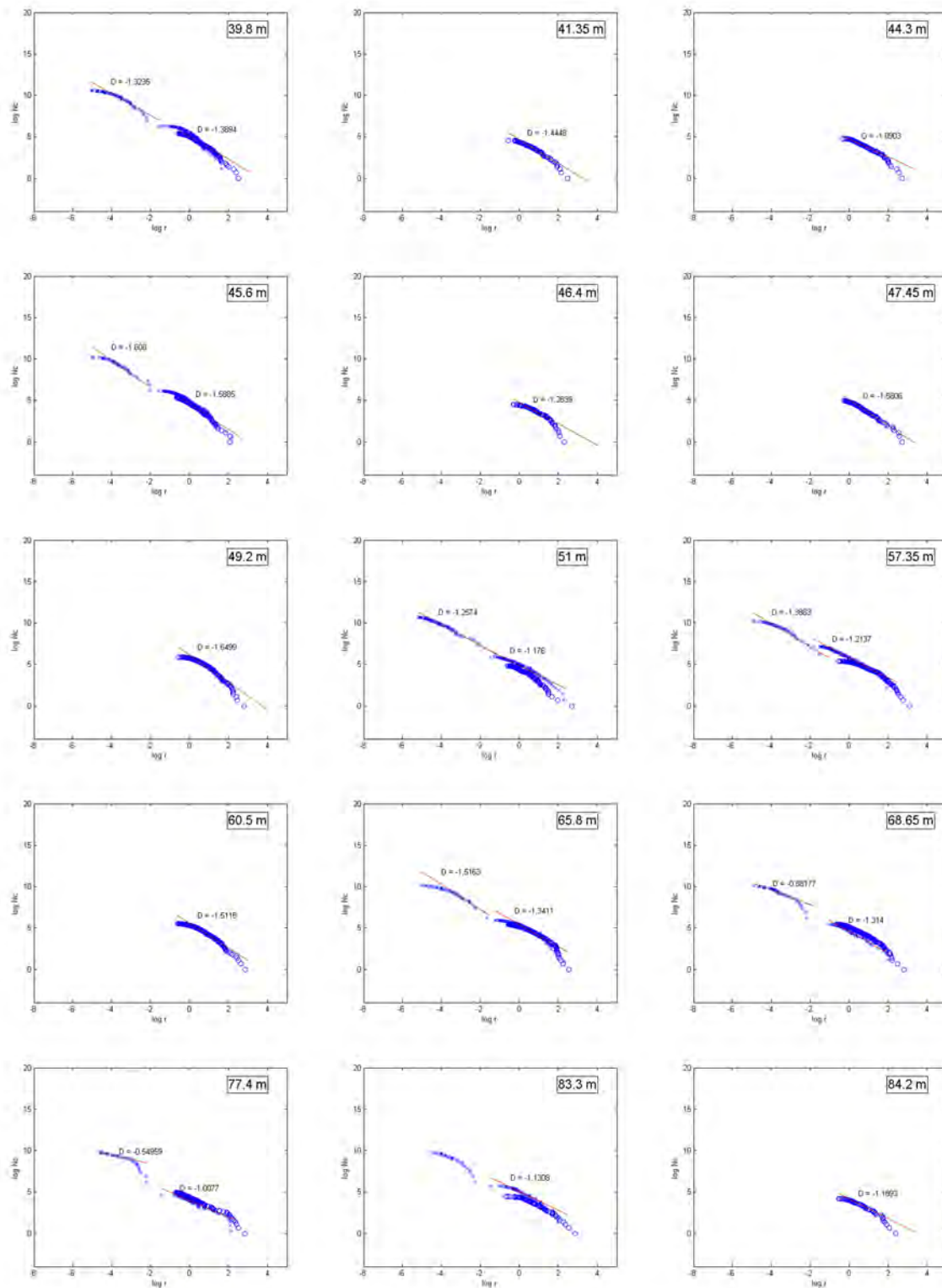


Fig. C.19.: Melt particles of Wörnitzostheim (39.8 - 84.2 m).

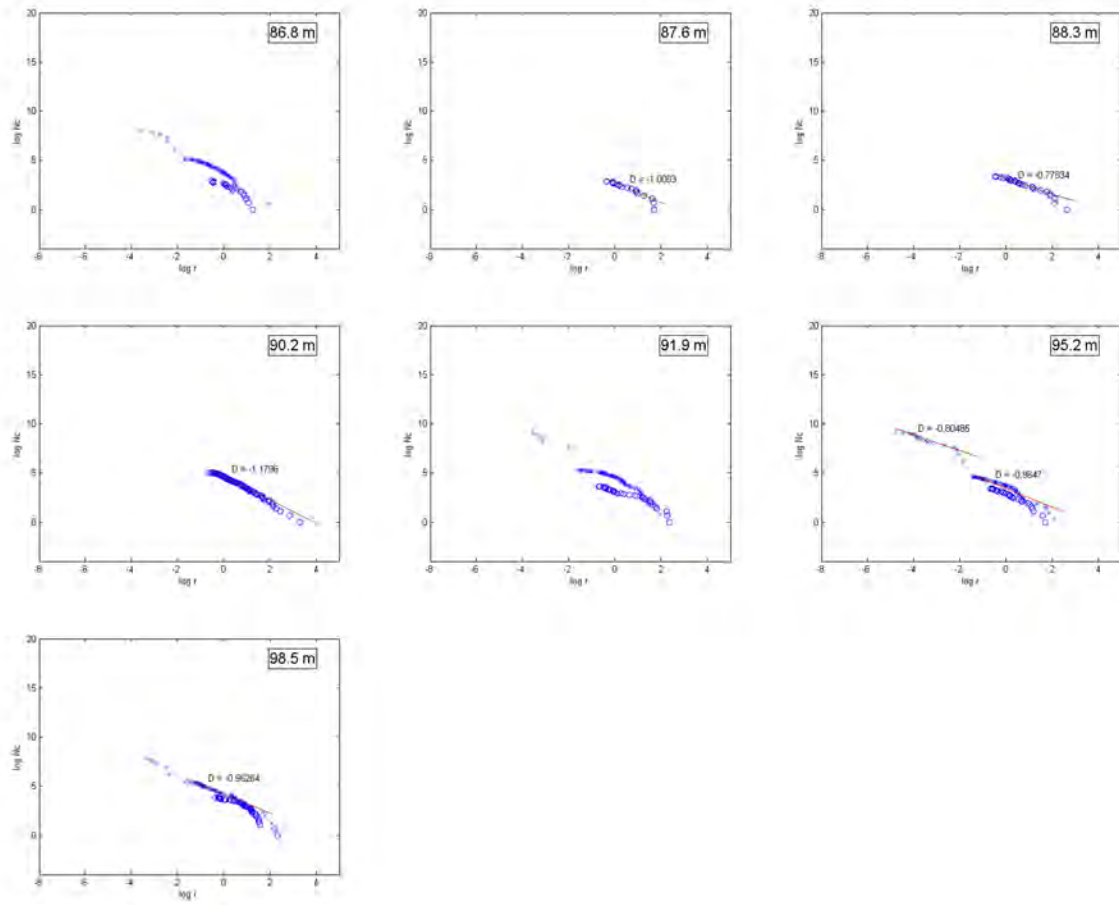


Fig. C.20.: Melt particles of Wörnitzostheim (86.8 - 98.5 m).

C. Appendix 3

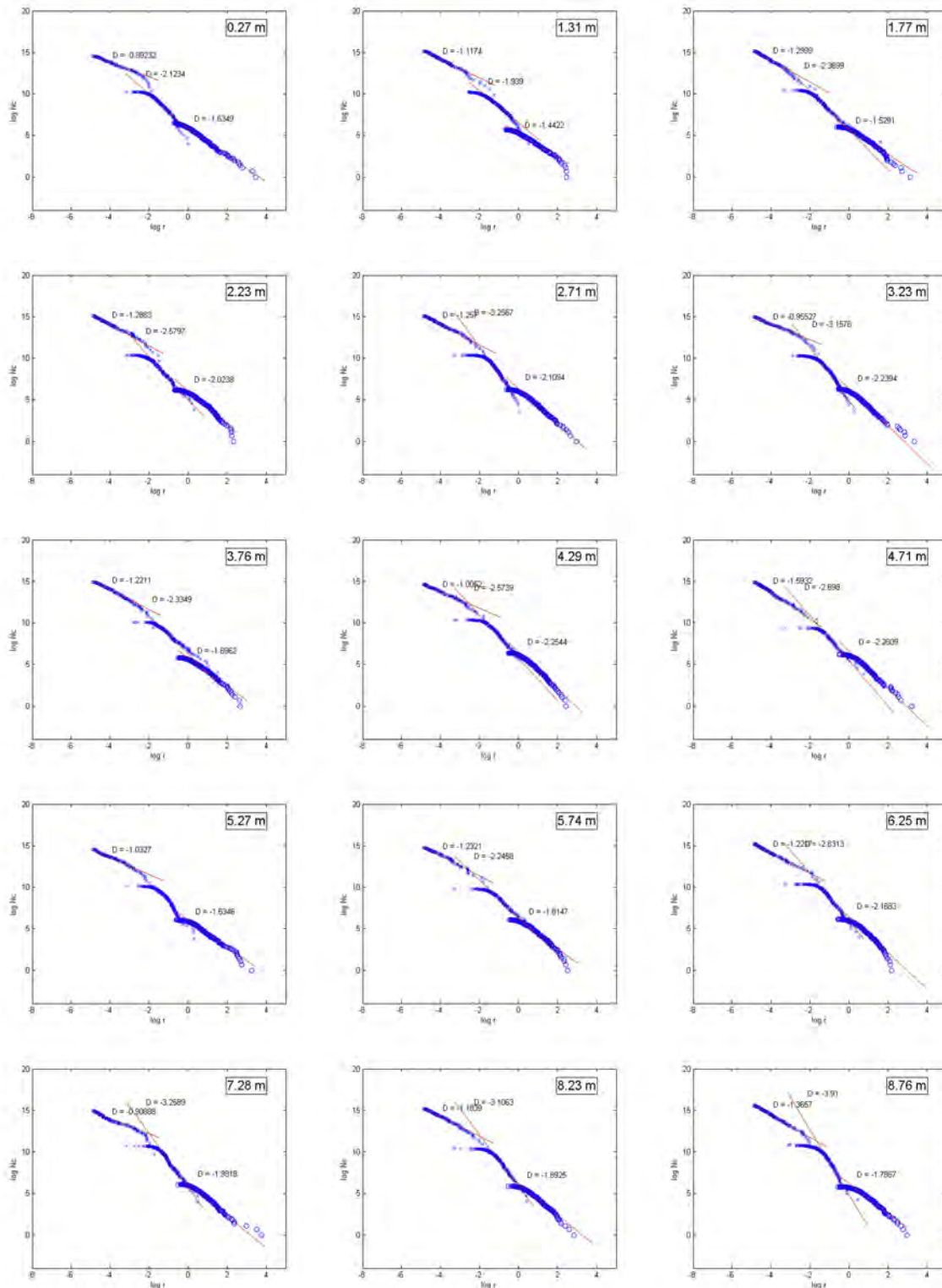


Fig. C.21.: Lithic clasts of Otting (0.27 - 8.76 m).

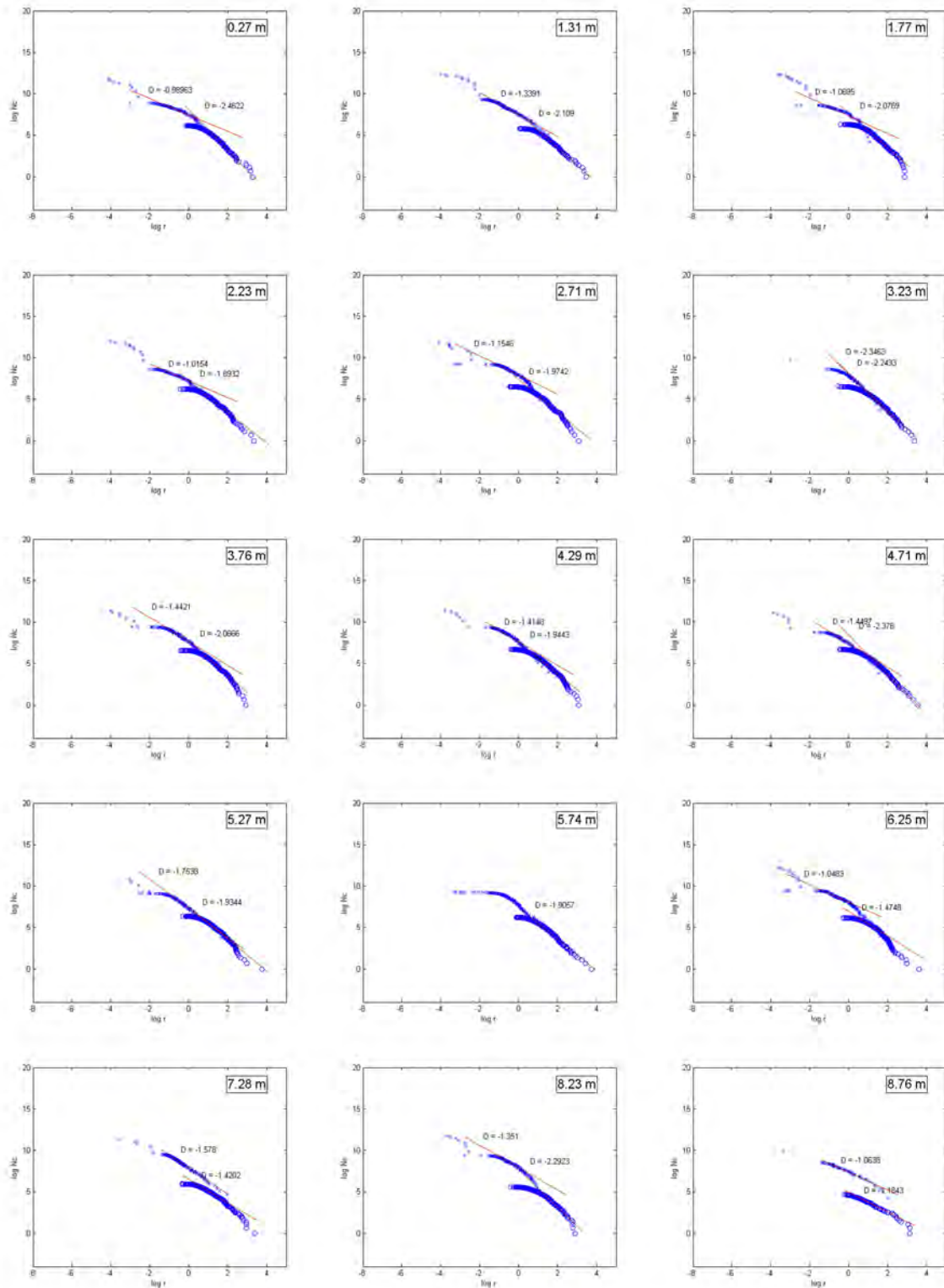


Fig. C.22.: Melt particles of Otting (0.27 - 8.76 m).

D. Appendix 4

Modal analyses of suevite matrix < 0.25 mm of FBN73, Enkingen, Wörnitzostheim, and Otting. Legend colors show the main elements of the particles. Elements below the images are from element mappings, which underlie the images of the colored minerals. SE images are performed with 15 kV and a working distance of 39 - 42 mm.

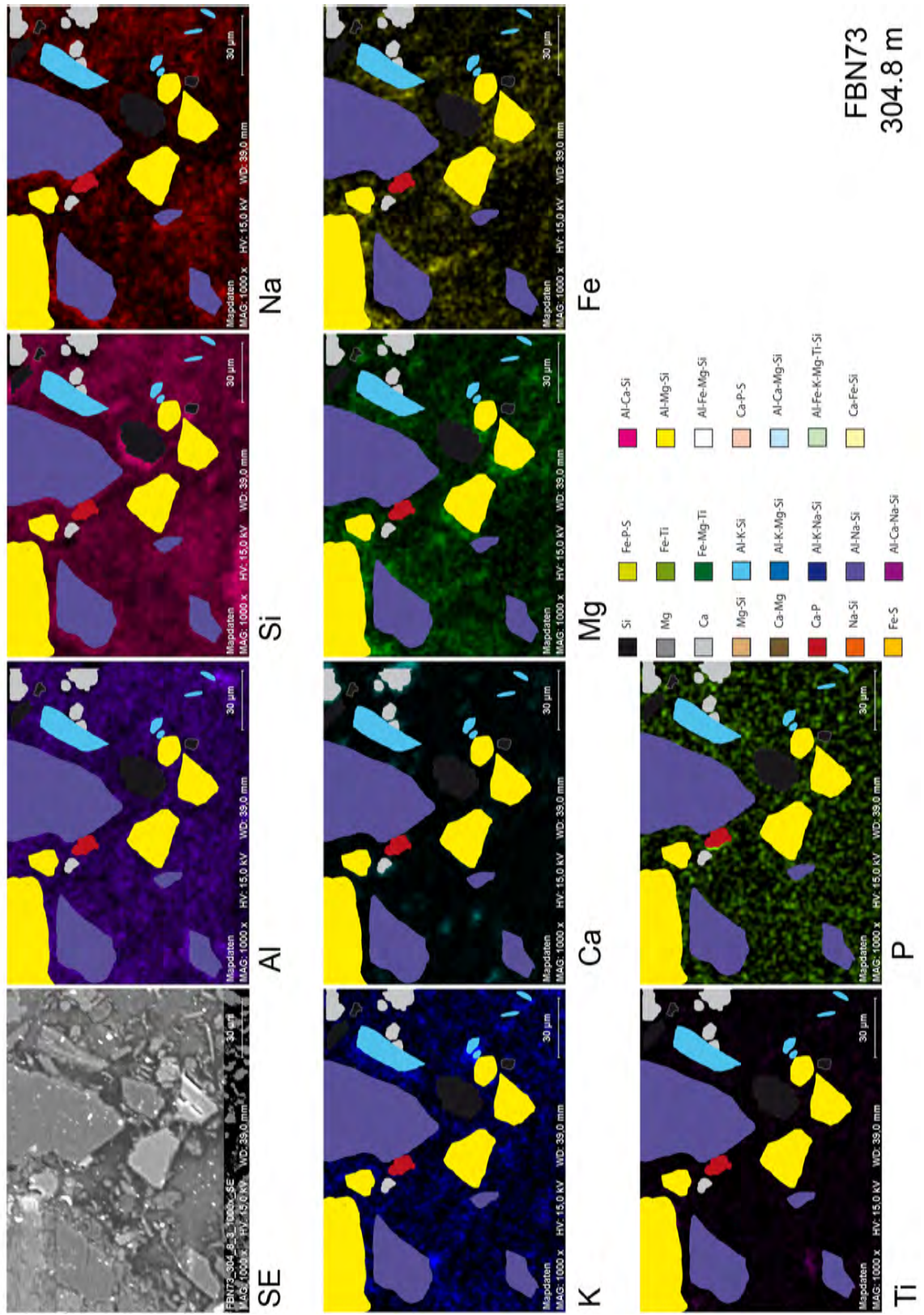


Fig. D.1.: FBN73 304.8 m

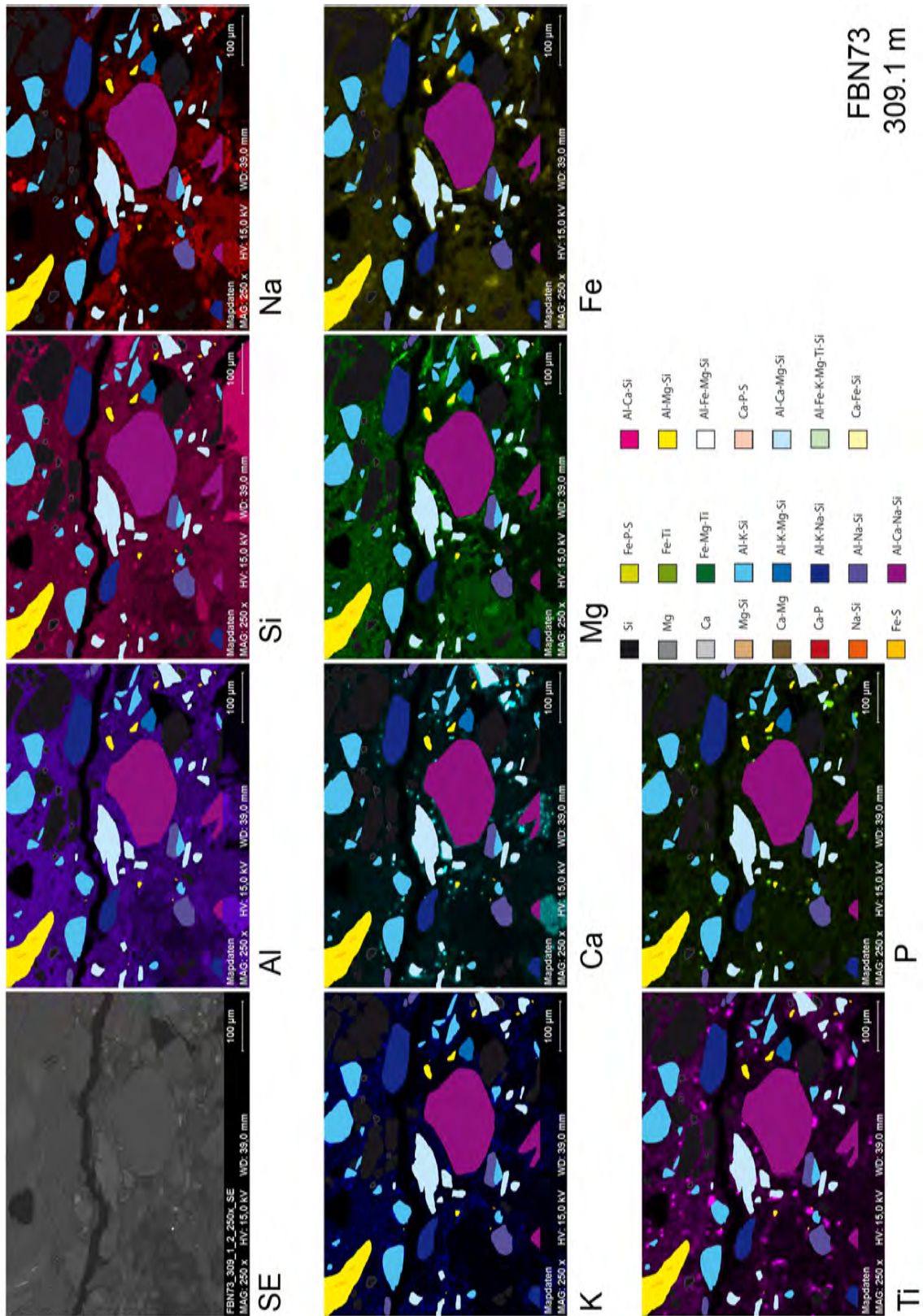


Fig. D.2.: FBN73 309.1 m

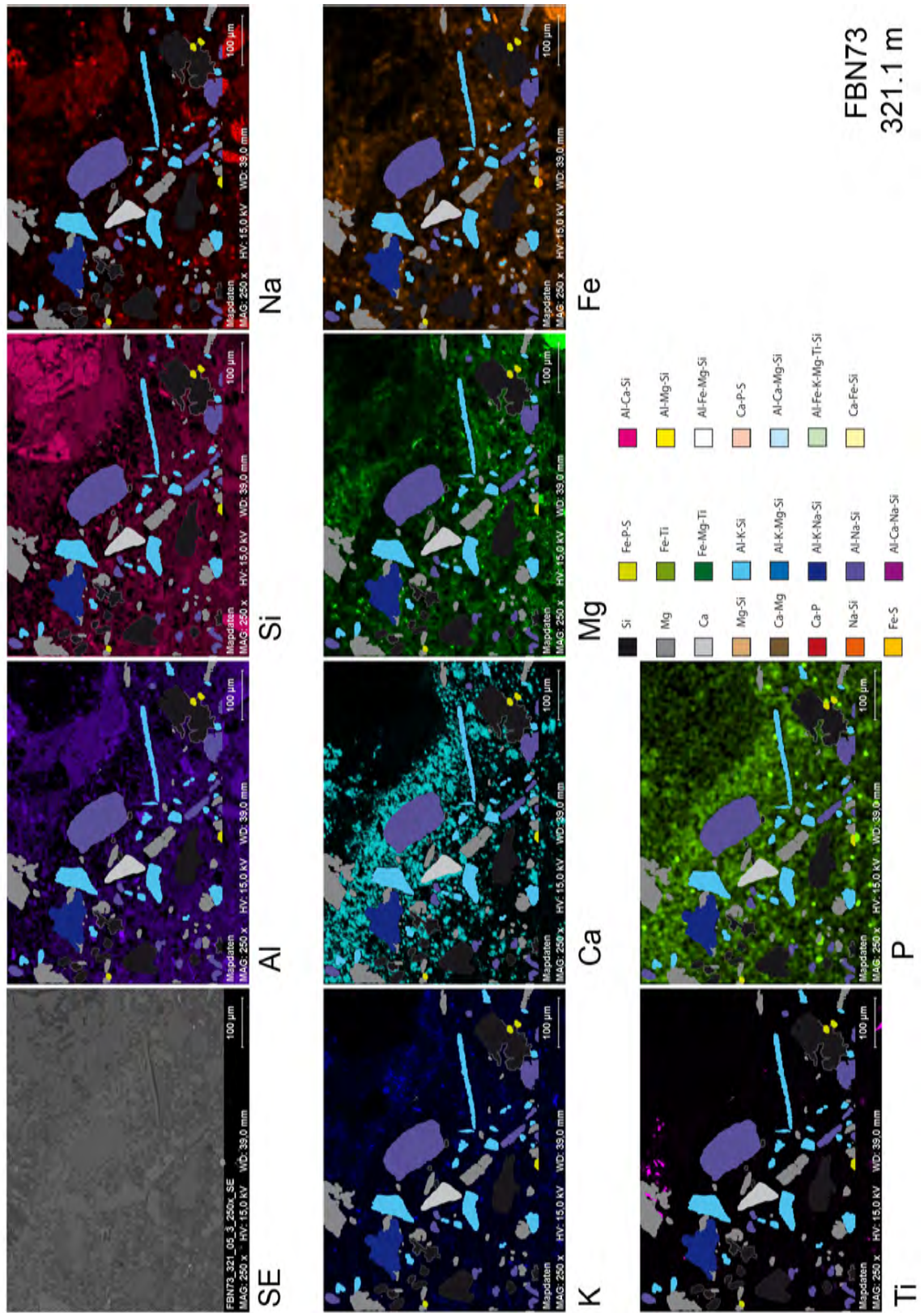


Fig. D.3.: FBN73 321.1 m

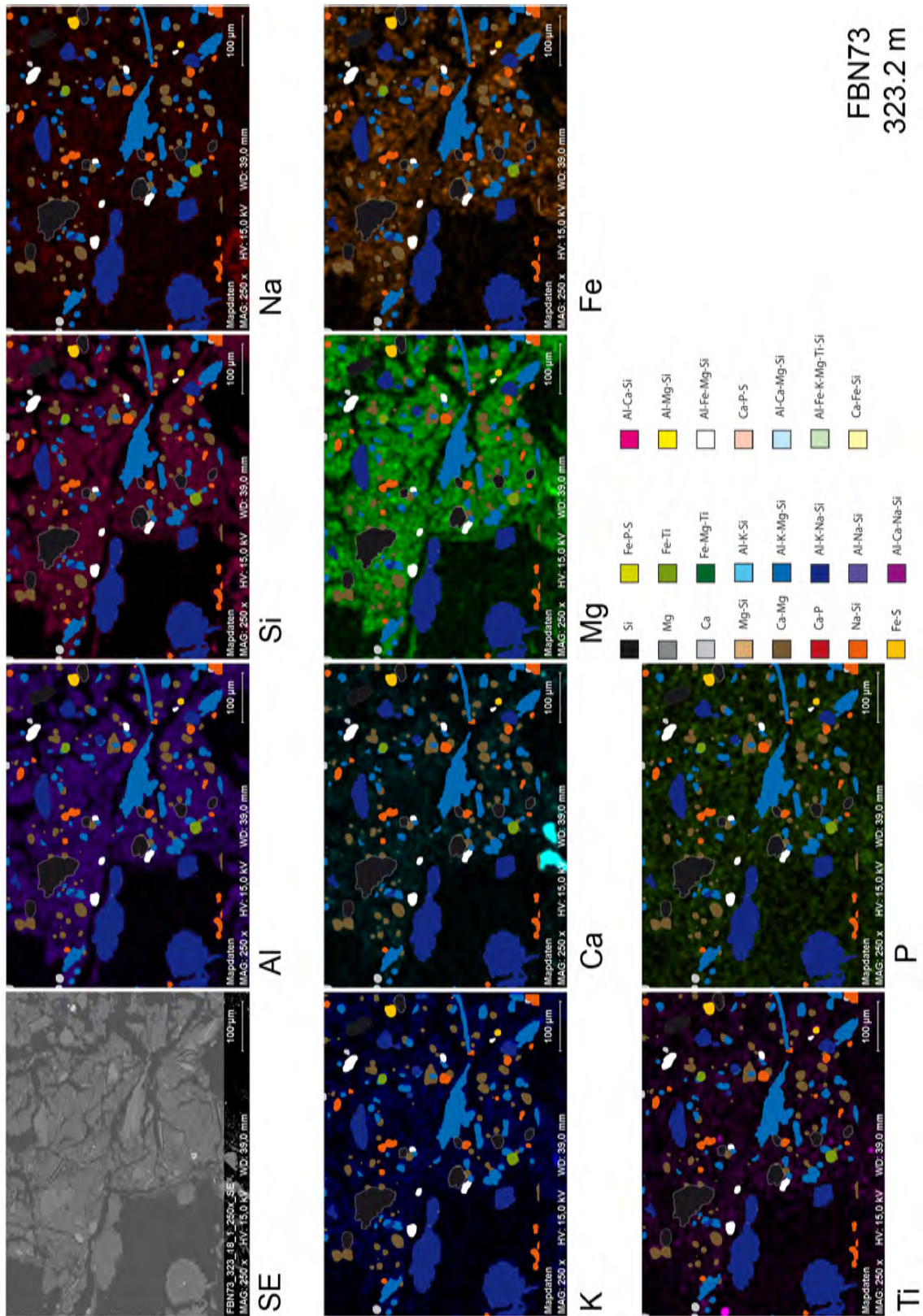


Fig. D.4.: FBN73 323.2 m

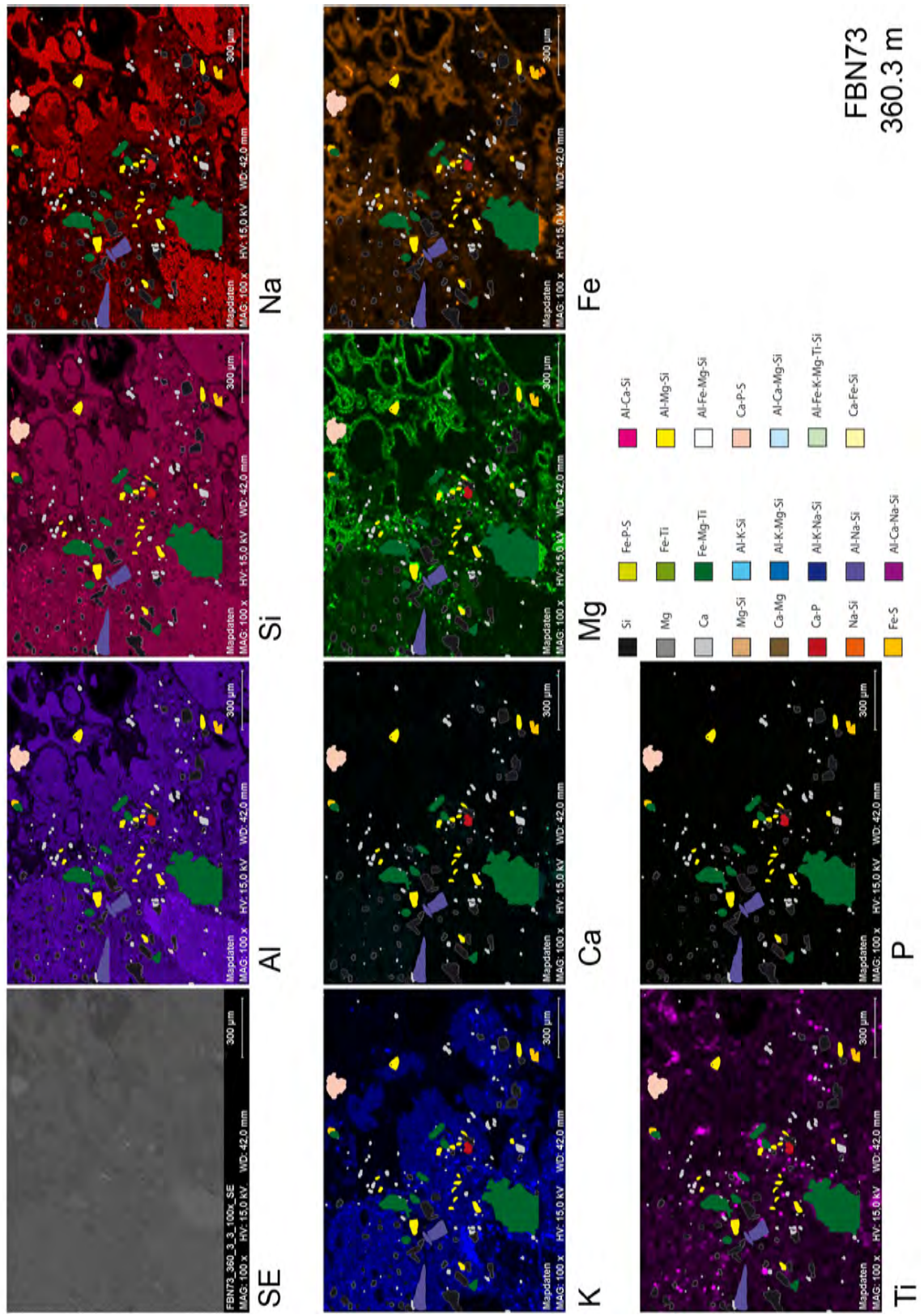


Fig. D.5.: FBN73 360.3 m

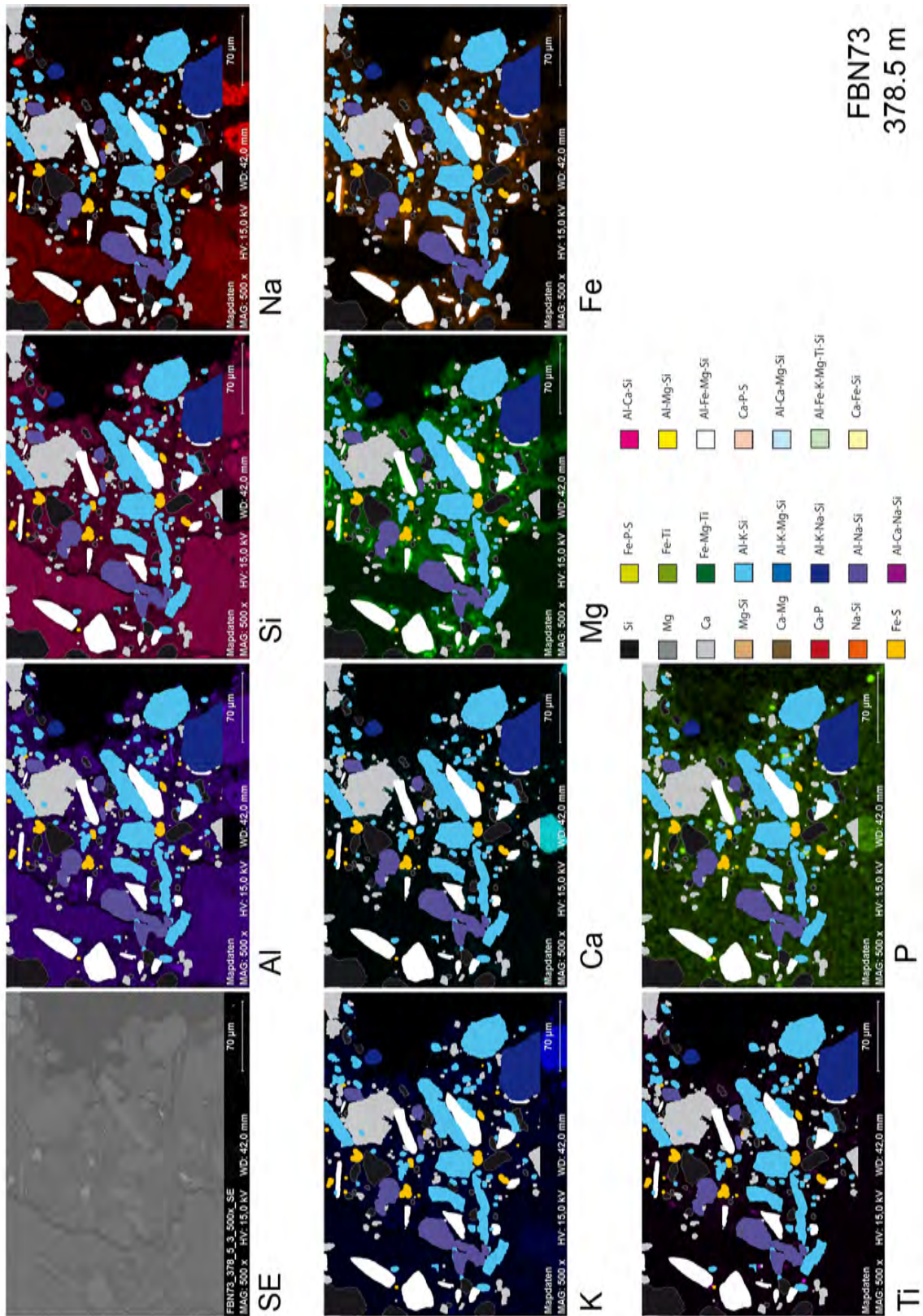


Fig. D.6.: FBN73 378.5 m

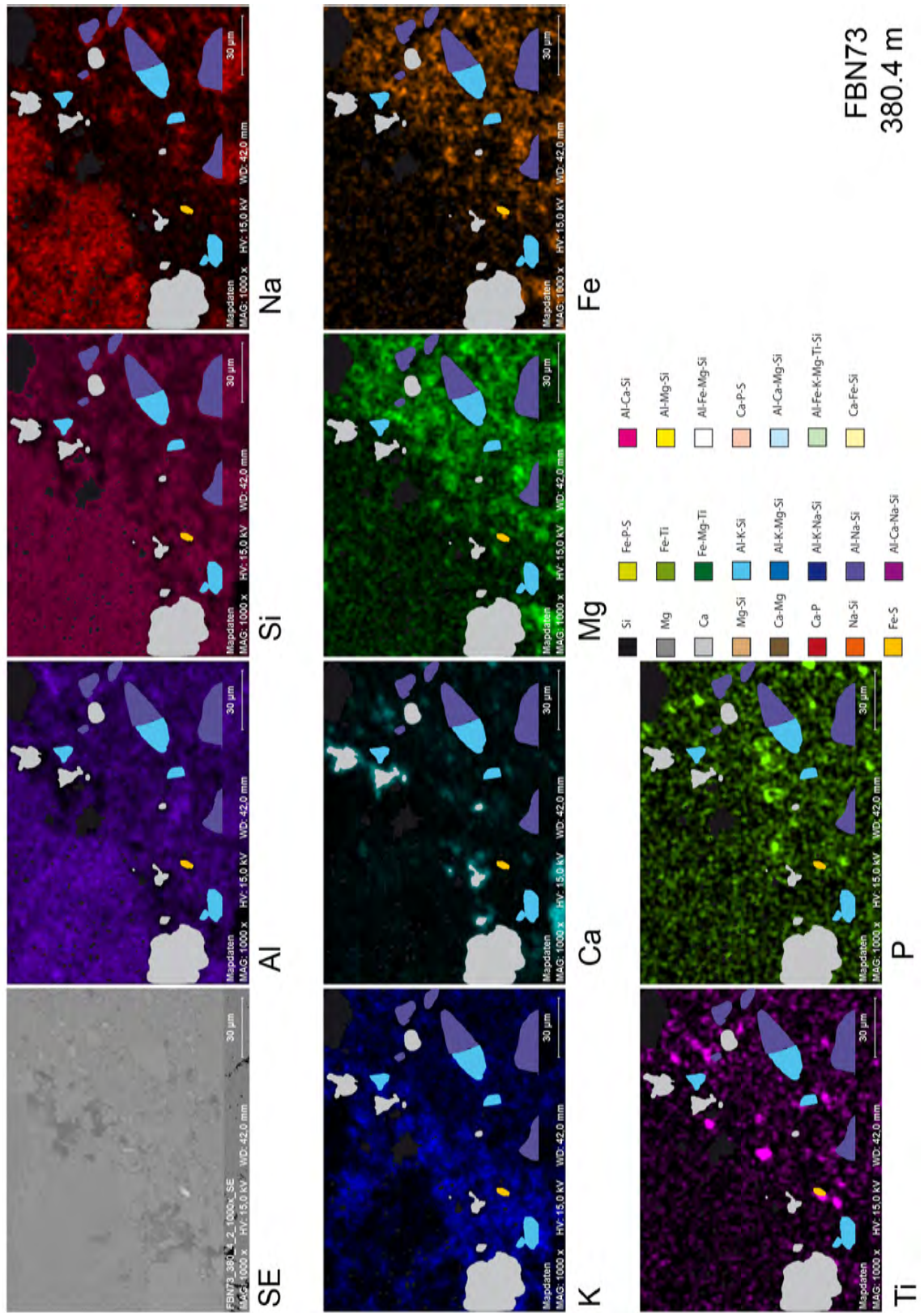


Fig. D.7.: FBN73 380.4 m

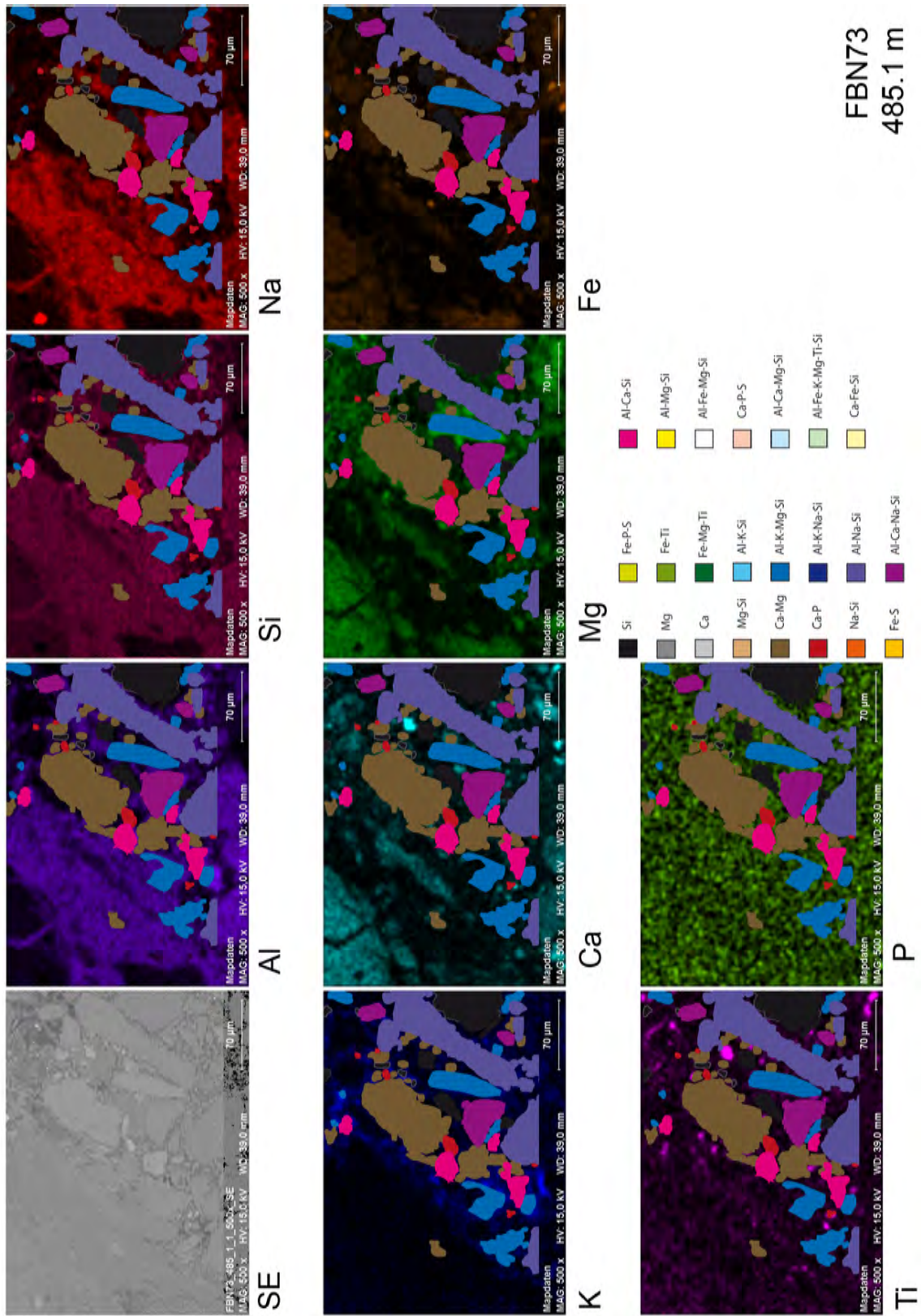


Fig. D.8.: FBN73 485.1 m

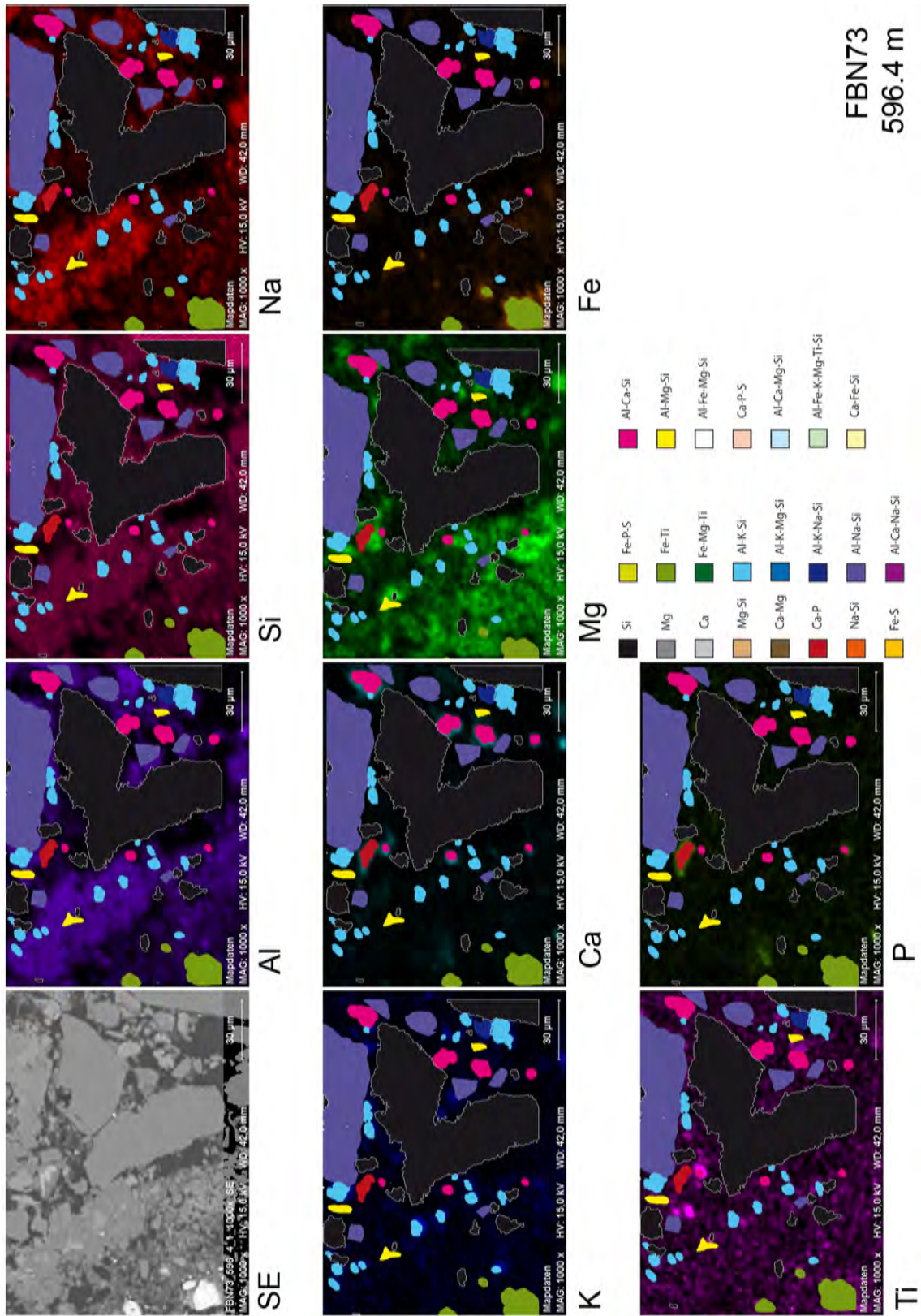


Fig. D.10.: FBN73 596.4 m

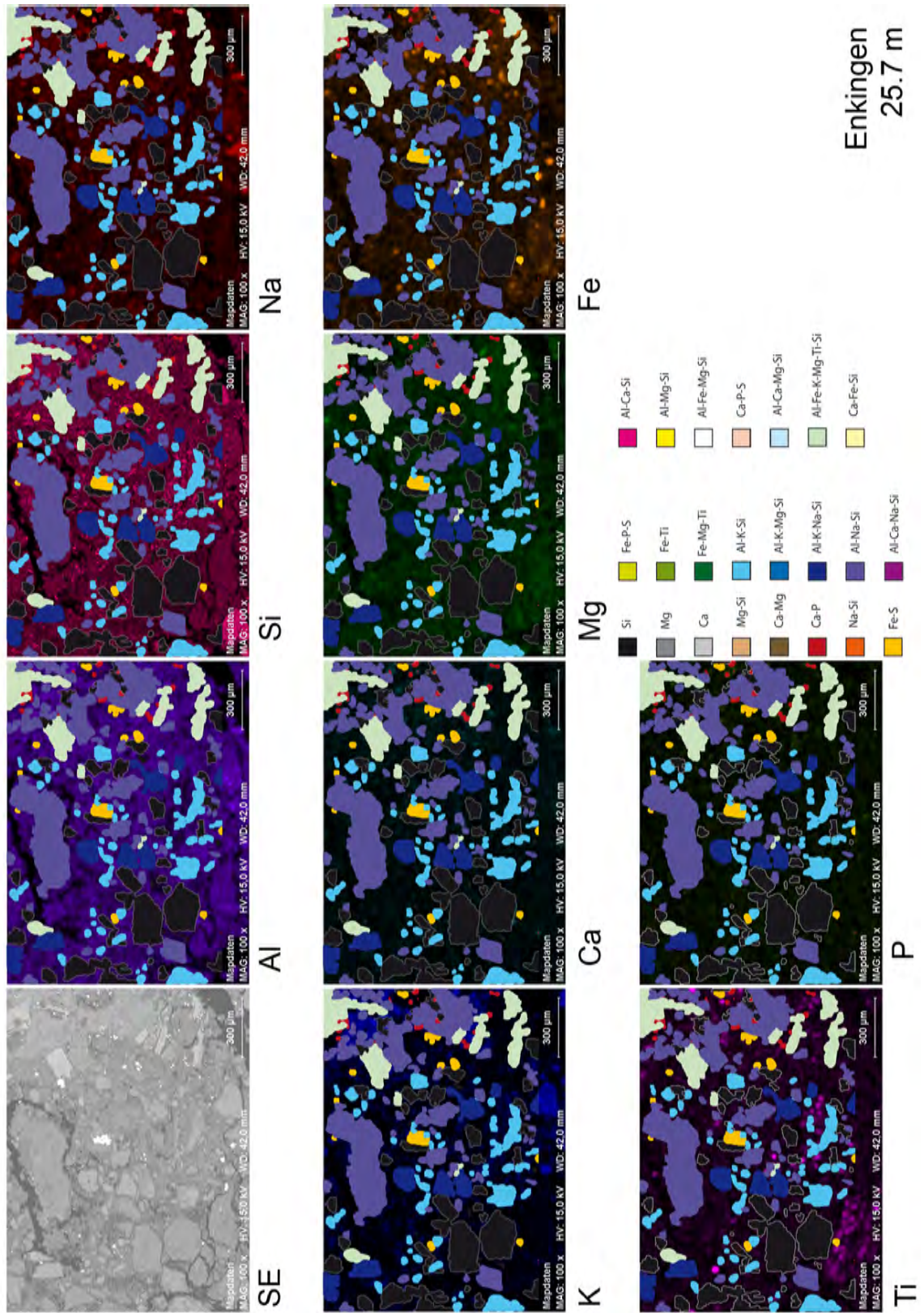


Fig. D.11.: Enkingen 25.7 m

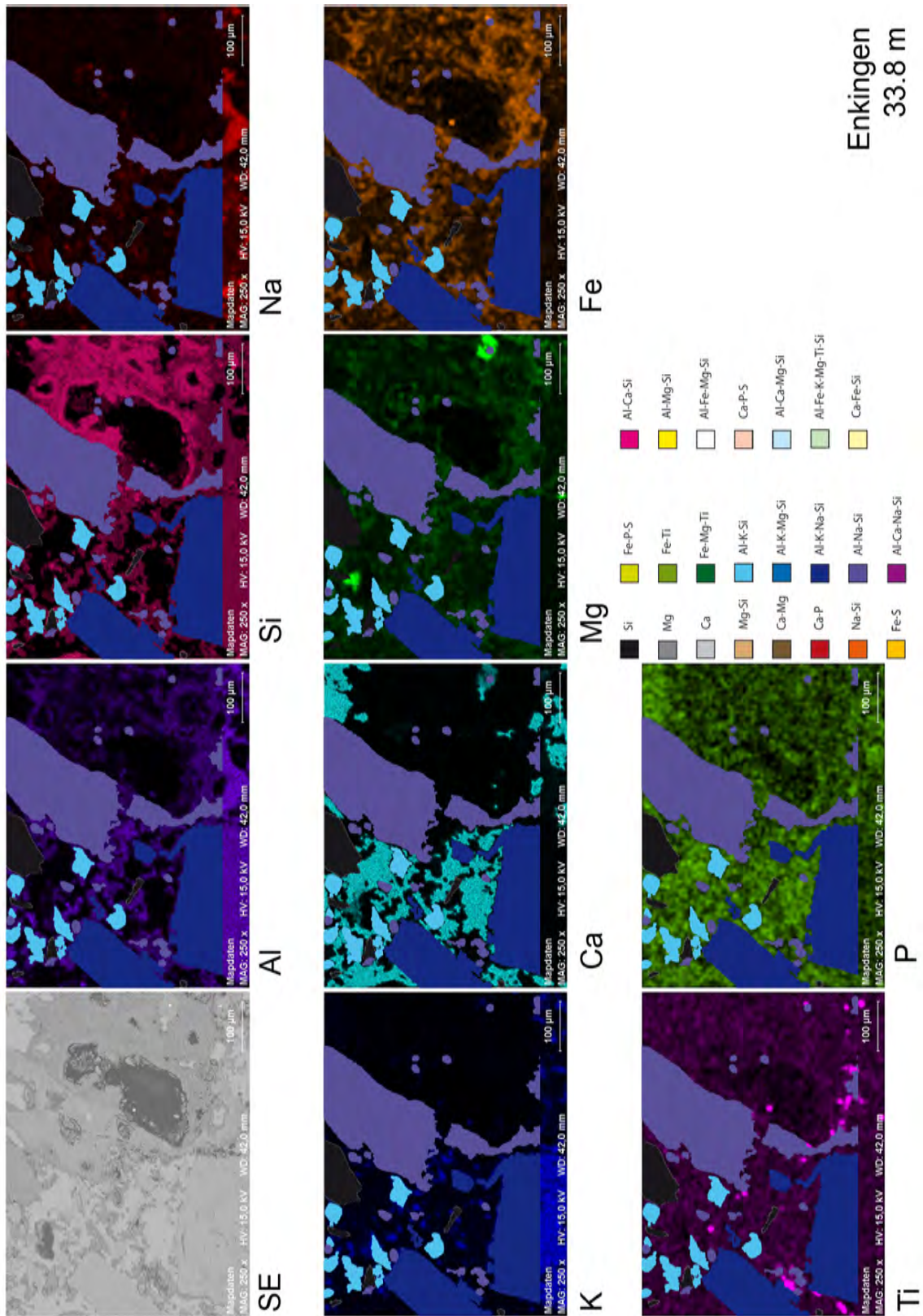


Fig. D.12.: Enkingen 33.8 m

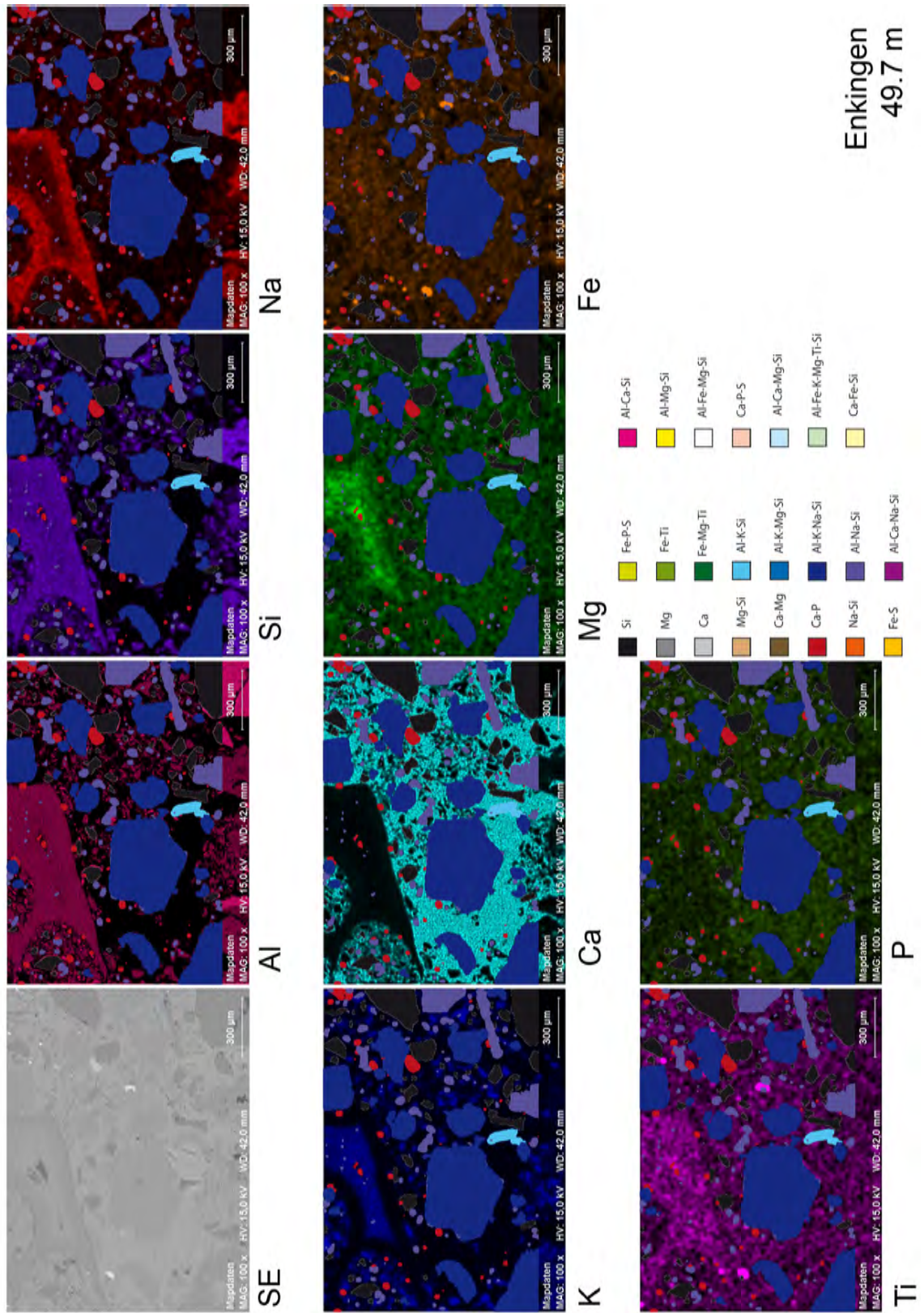


Fig. D.13.: Enkingen 49.7 m

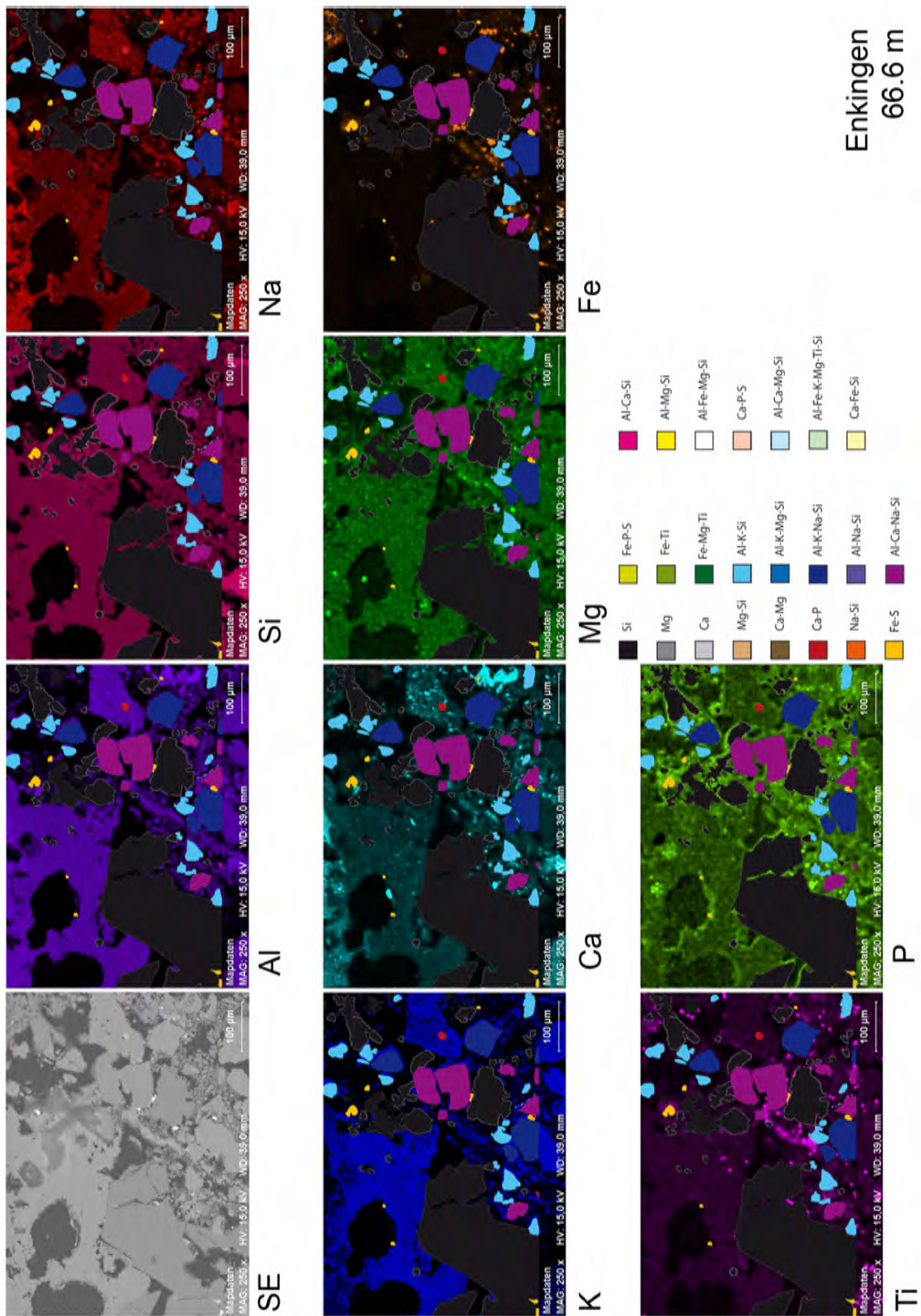


Fig. D.14.: Enkingen 66.6 m

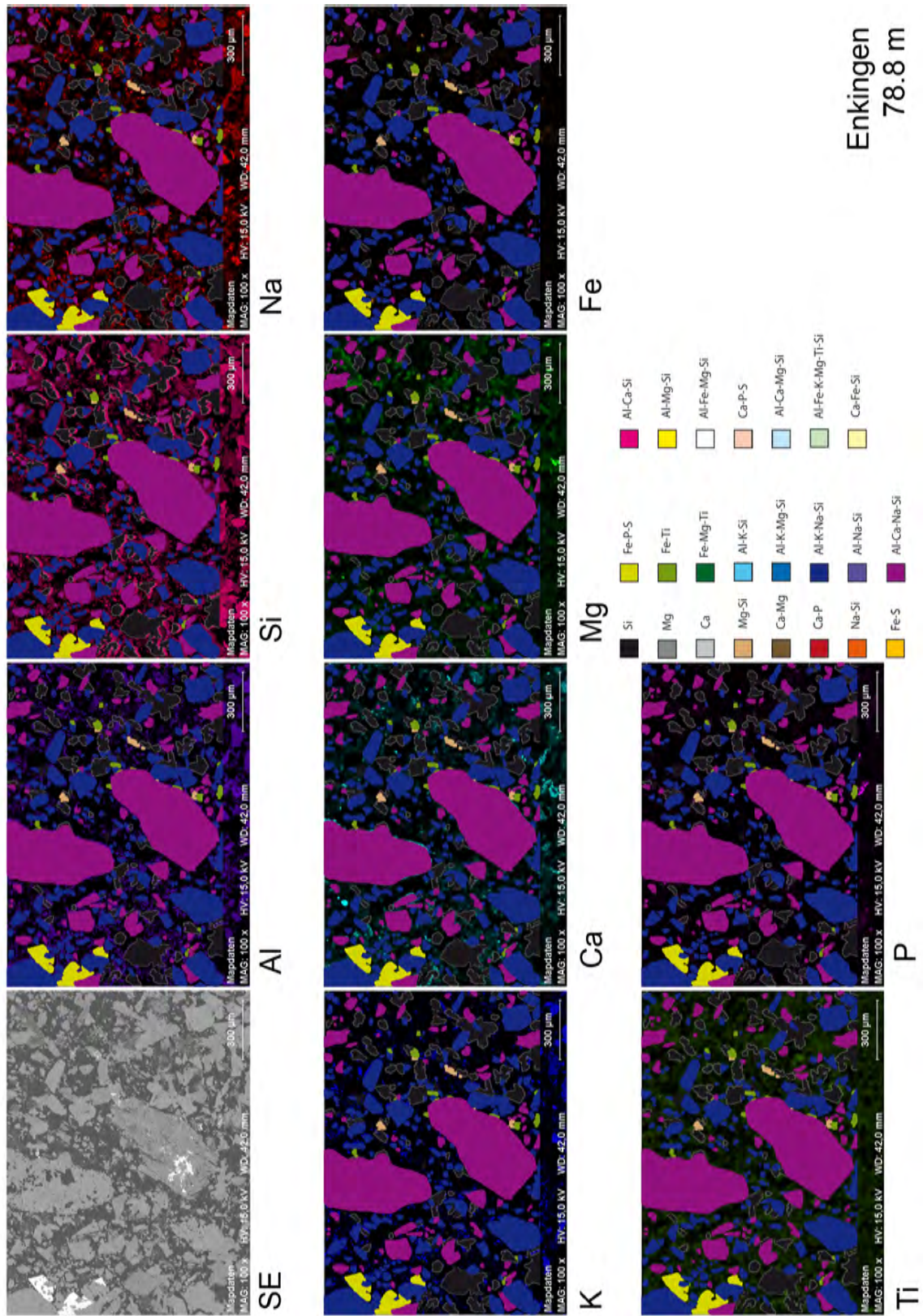


Fig. D.15.: Enkingen 78.8 m

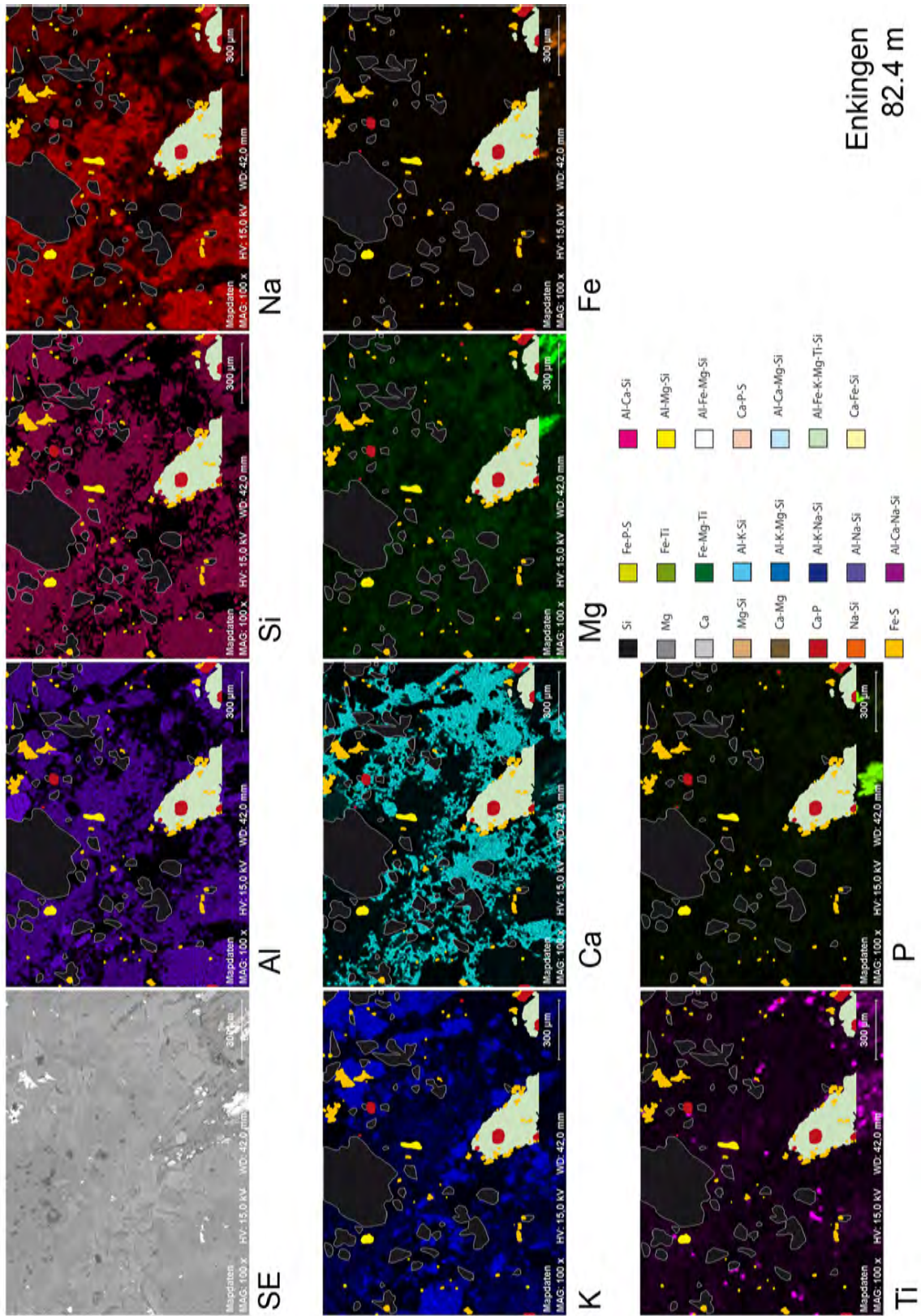


Fig. D.16.: Enkingen 82.4 m

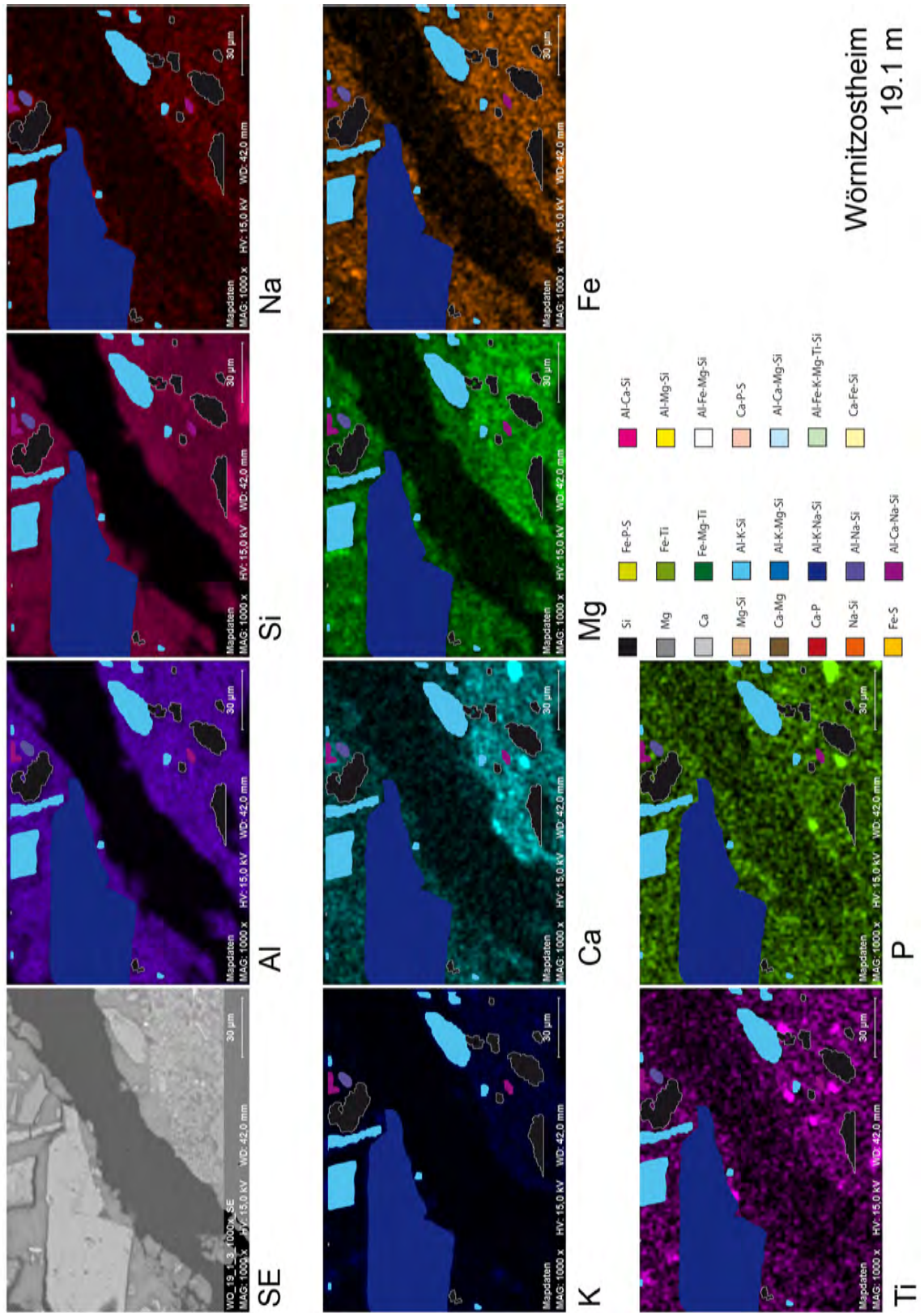


Fig. D.17.: Wörnitzostheim 19.1 m

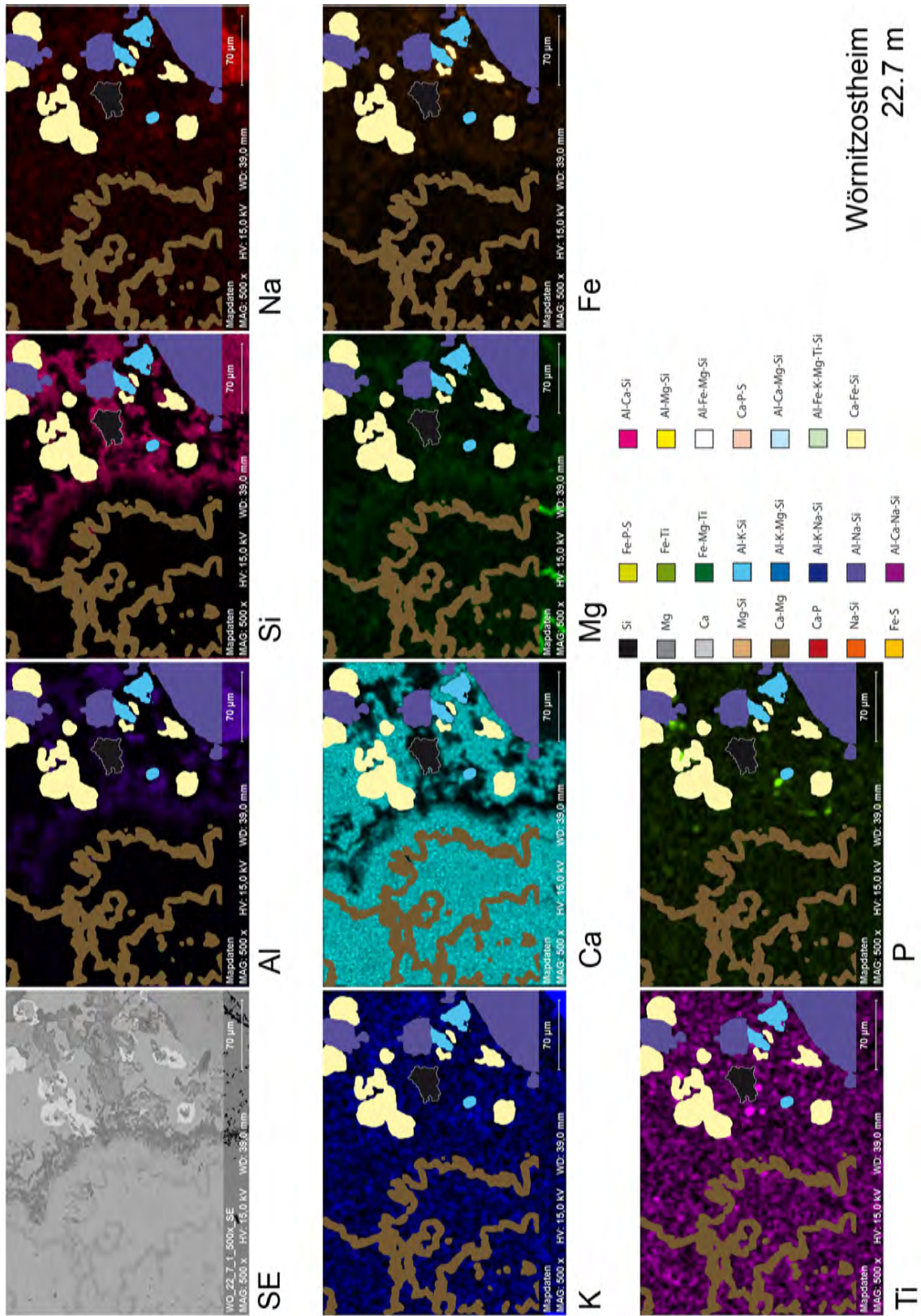


Fig. D.18.: Wörnitzostheim 22.7 m

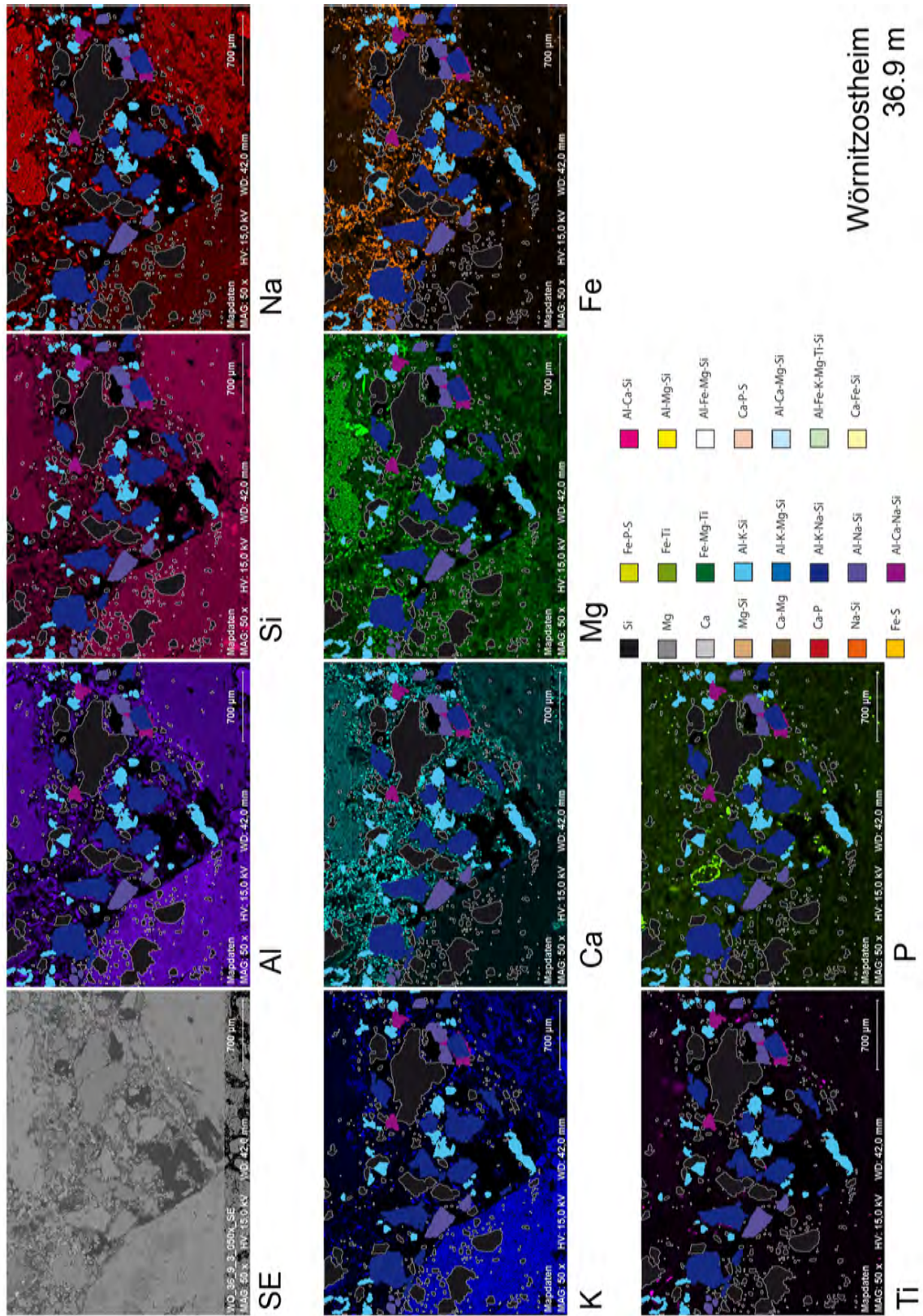


Fig. D.19.: Wörnitzostheim 36.9 m

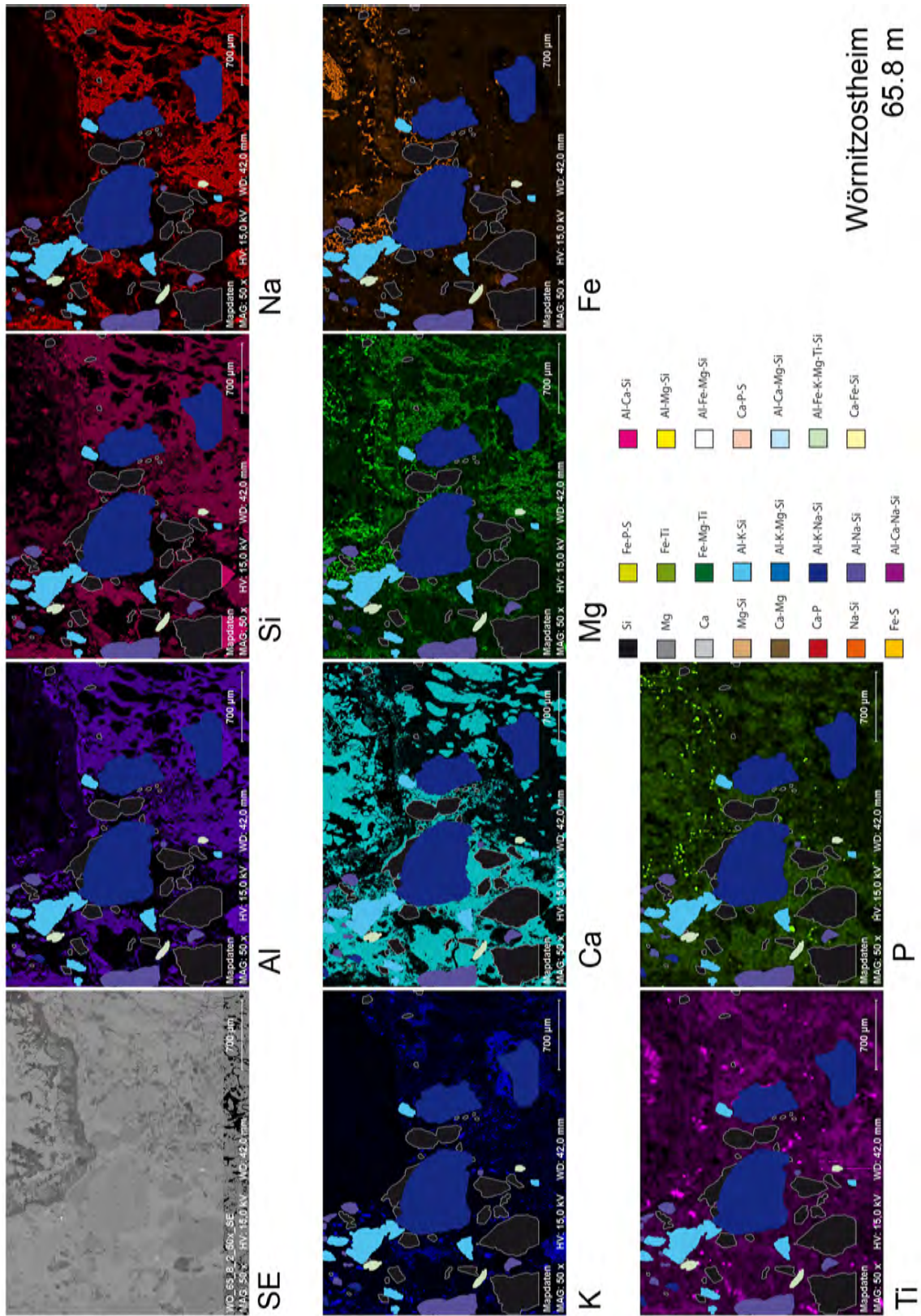


Fig. D.20.: Wörnitzostheim 65.8 m

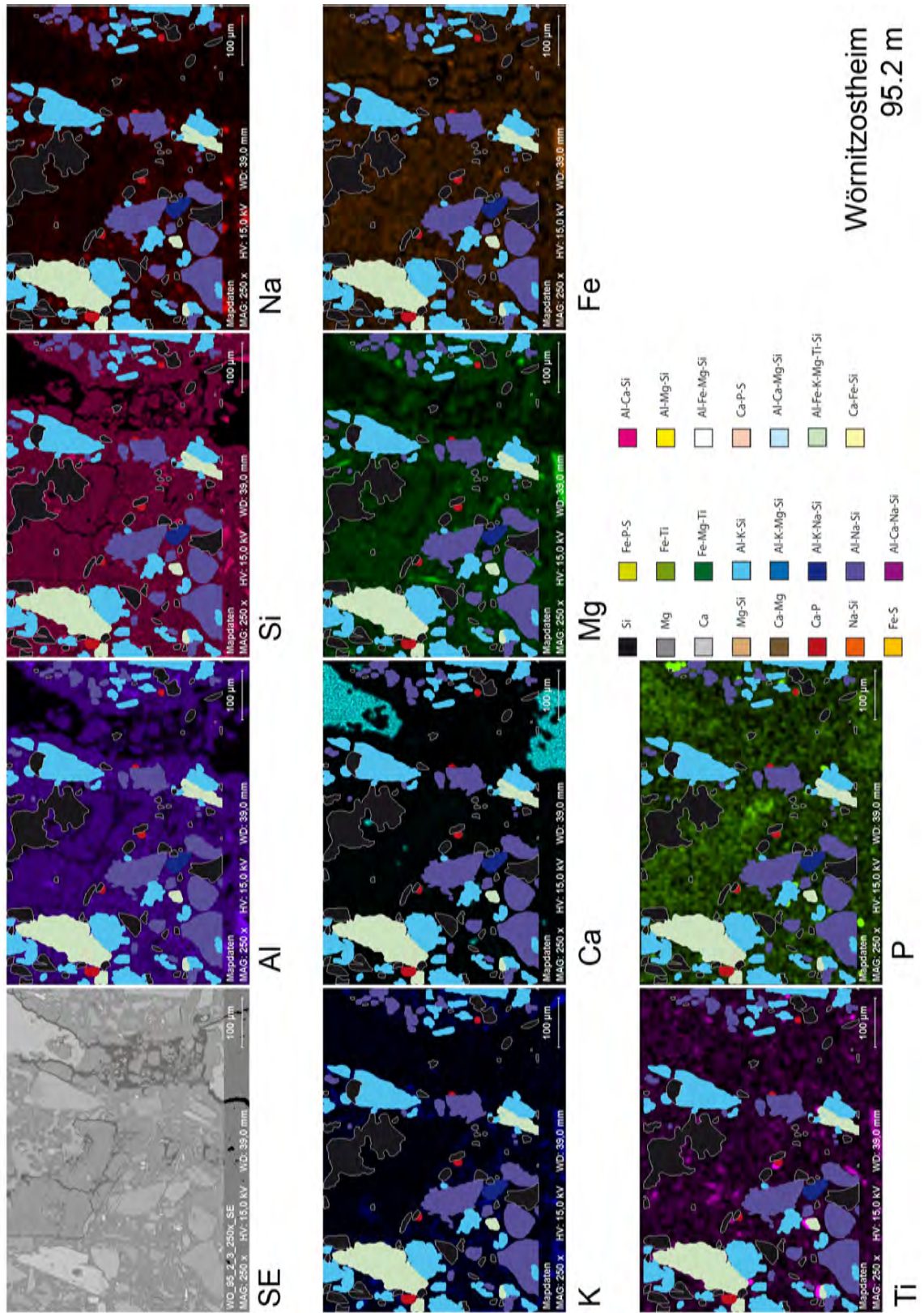


Fig. D.21.: Wörnitzostheim 95.2 m

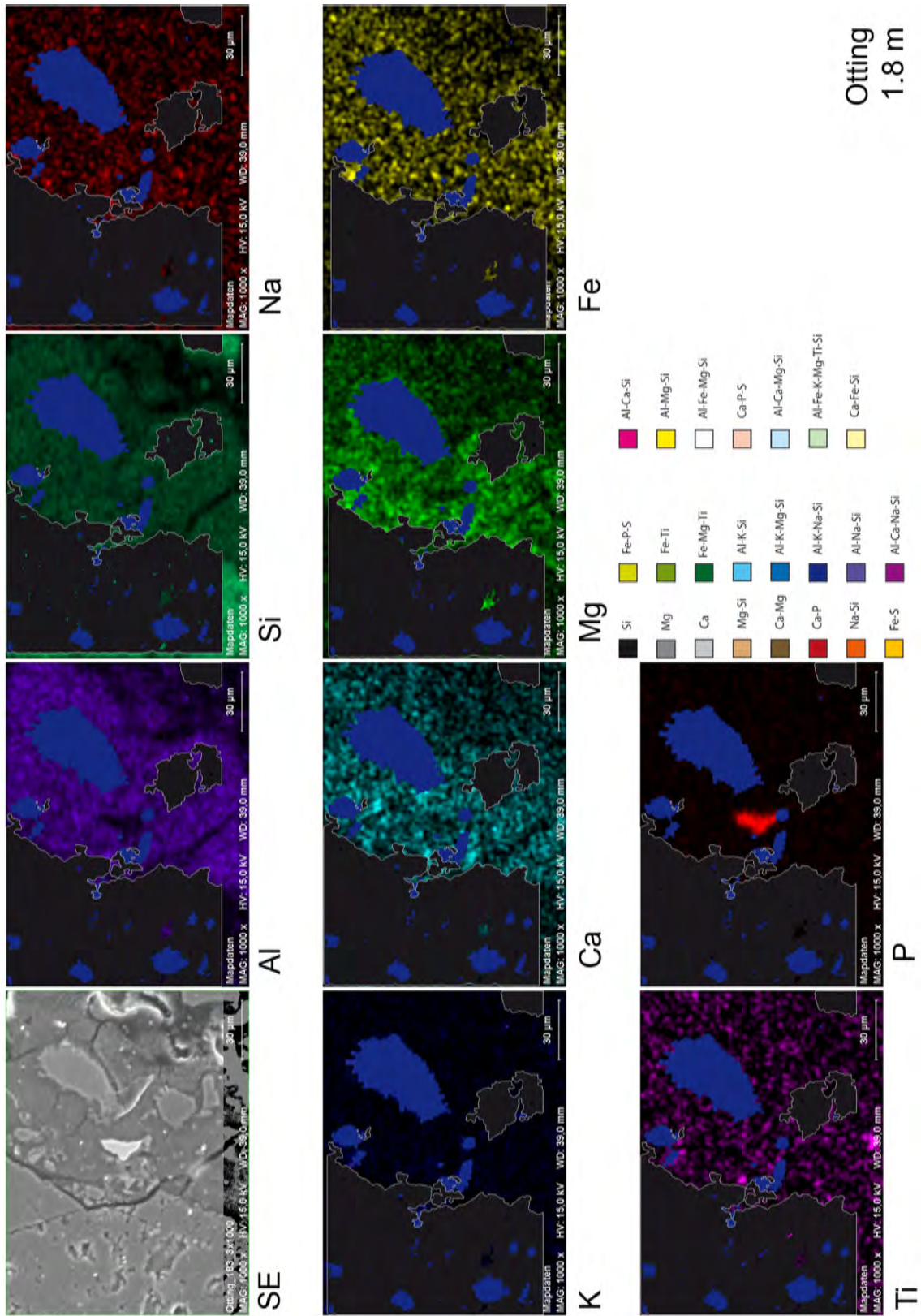


Fig. D.22.: Otting 1.8 m

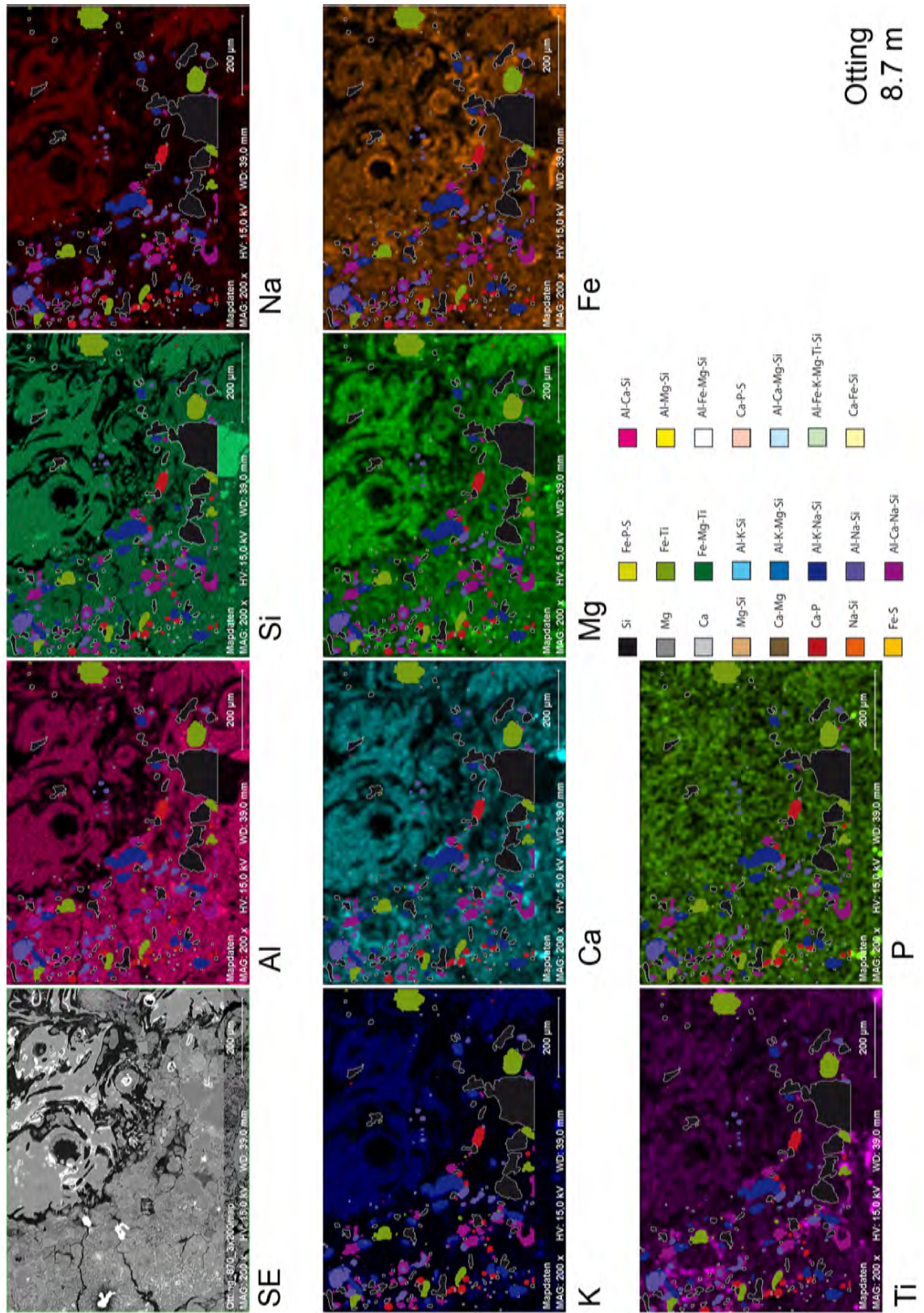


Fig. D.23.: Otting 8.7 m

E. Appendix 5

Ternary diagrams and points of EMPA measurements of FBN73, Wörnitzostheim, Enkingen, and Otting drill cores; data plotted in weight percent. Chemical composition of target rocks are from Graup (1977), chemical composition of clay minerals and zeolites are from Osinski (2005), Stähle (1972), Stähle and Ottemann (1977).

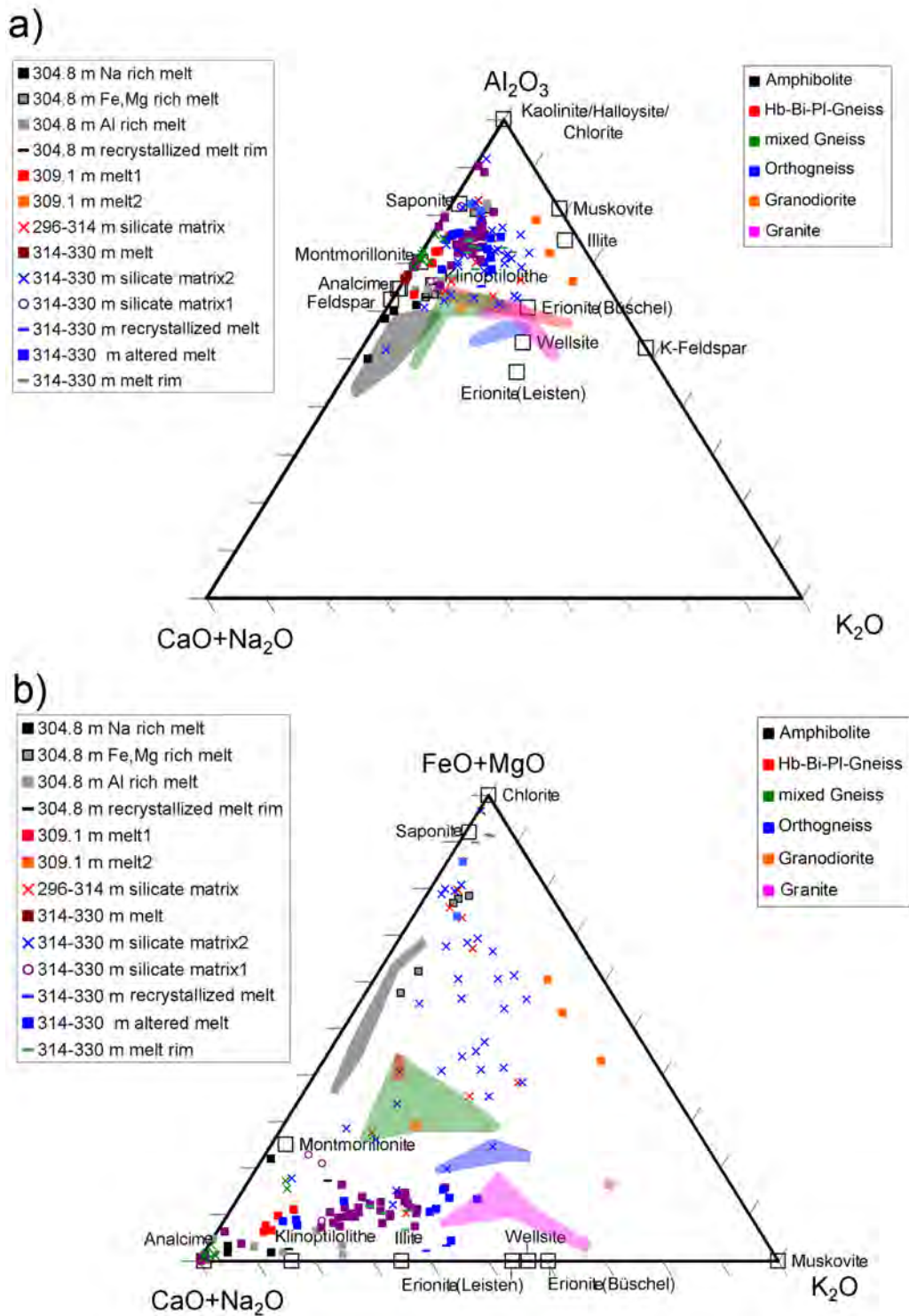


Fig. E.1.: FBN73: a) Al_2O_3 (A) – $\text{CaO}+\text{Na}_2\text{O}$ (CN) – K_2O (K) diagram of 304 - 330 m depth; b) $\text{FeO}+\text{MgO}$ (FM) – $\text{CaO}+\text{Na}_2\text{O}$ (CN) – K_2O (K) diagram of 304 - 330 m depth.

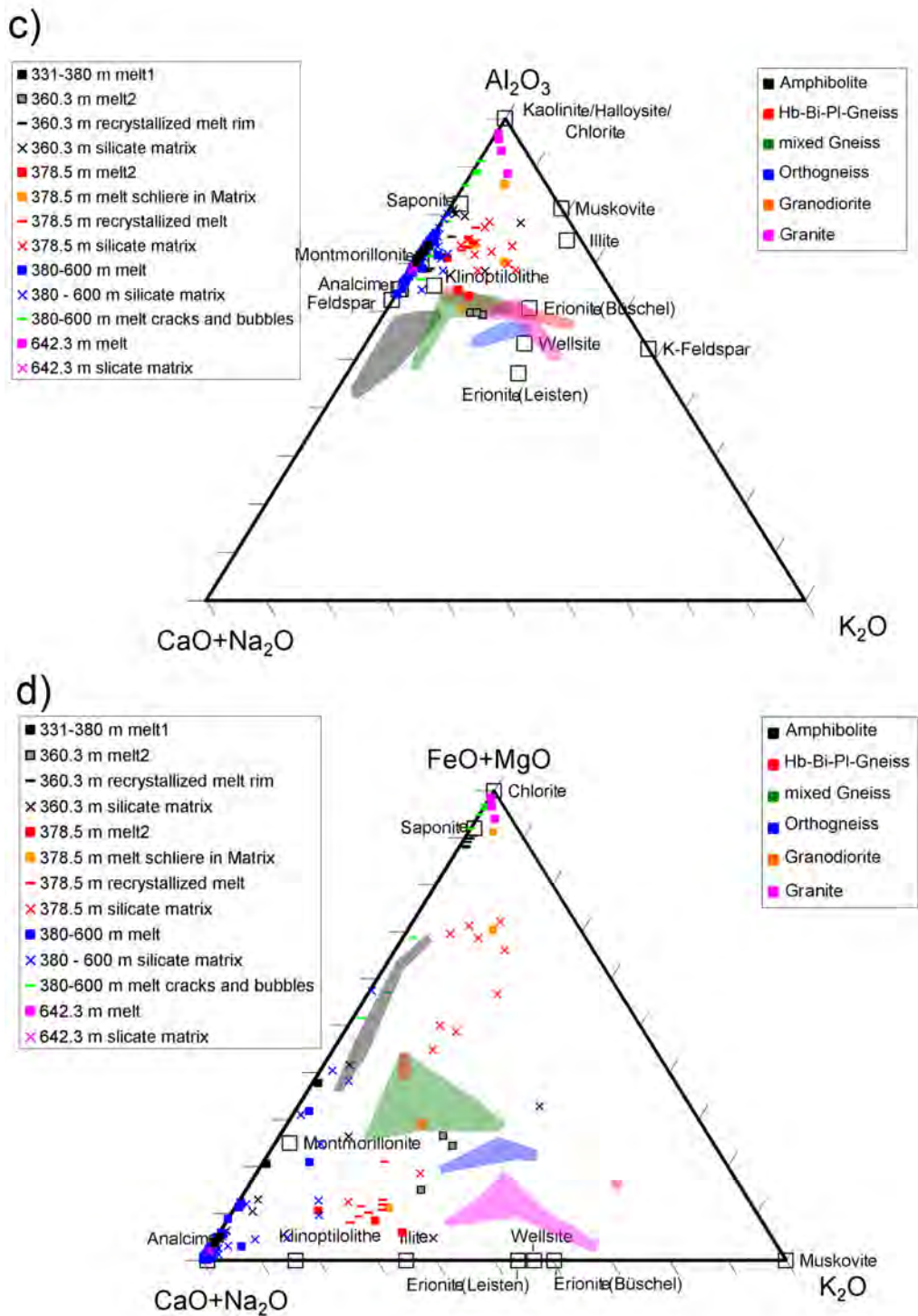


Fig. E.2.: FBN73: c) Al_2O_3 (A) – $\text{CaO}+\text{Na}_2\text{O}$ (CN) – K_2O (K) diagram of 331 - 642 m depth; d) $\text{FeO}+\text{MgO}$ (FM) – $\text{CaO}+\text{Na}_2\text{O}$ (CN) – K_2O (K) diagram of 331 - 642 m depth.

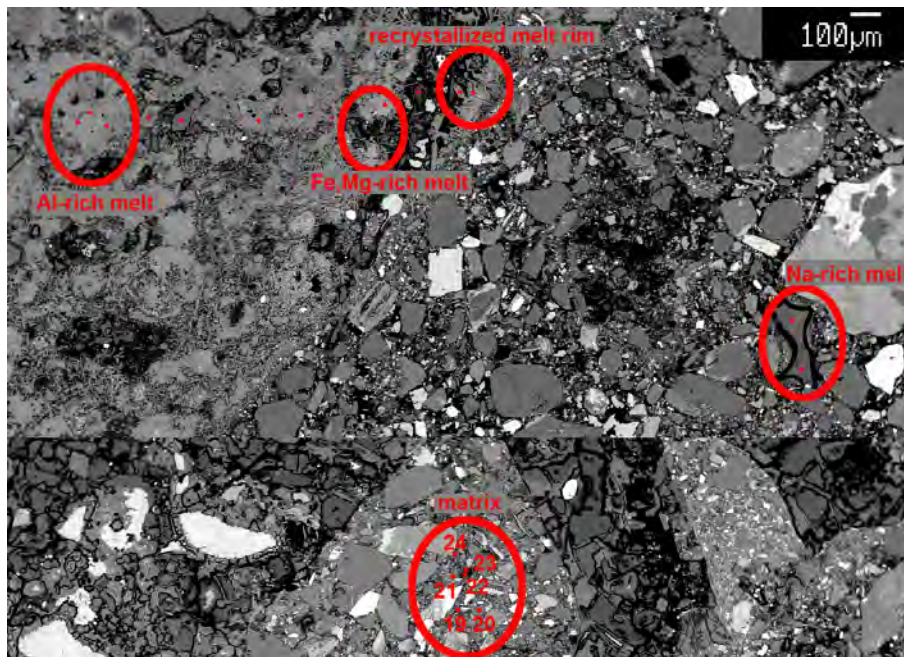


Fig. E.3.: FBN73: Points of EMPA measurements of melt particles and suevite matrix drawn in BSE images. 304.8 m depth.

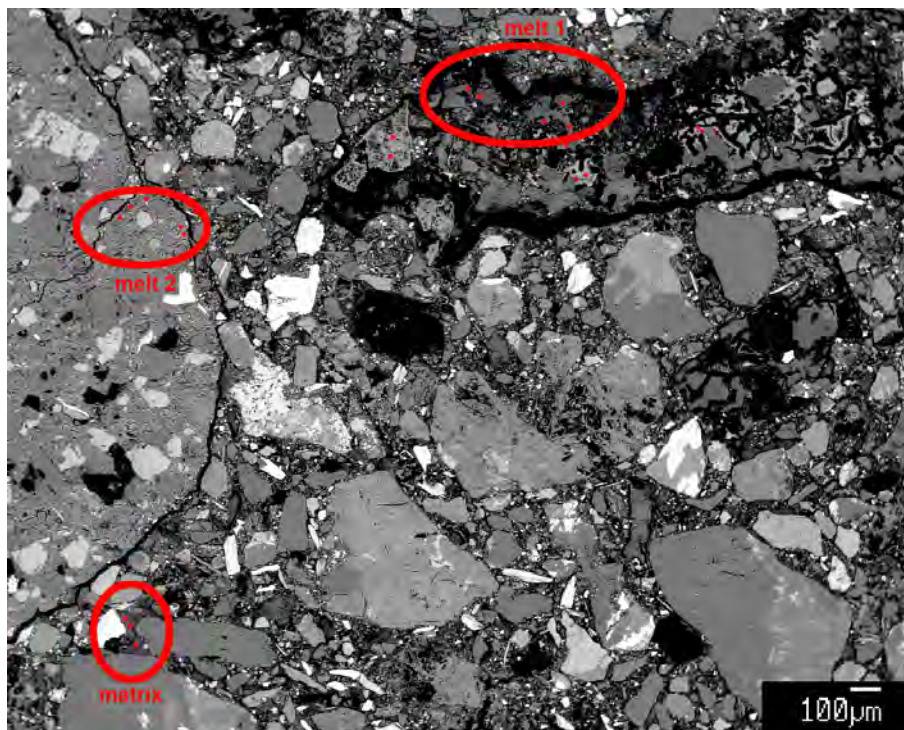


Fig. E.4.: FBN73: Points of EMPA measurements of melt particles and suevite matrix drawn in BSE images. 309.1 m depth.

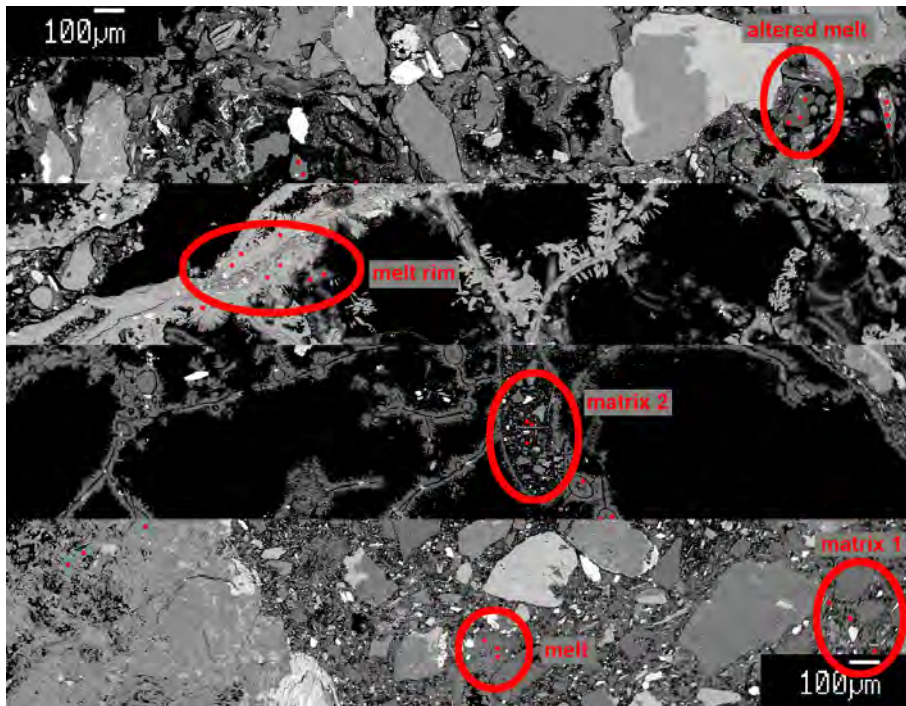


Fig. E.5.: FBN73: Points of EMPA measurements of melt particles and suevite matrix drawn in BSE images. 314 - 330 m depth.



Fig. E.6.: FBN73: Points of EMPA measurements of melt particles and suevite matrix drawn in BSE images. 331 - 378 m depth.

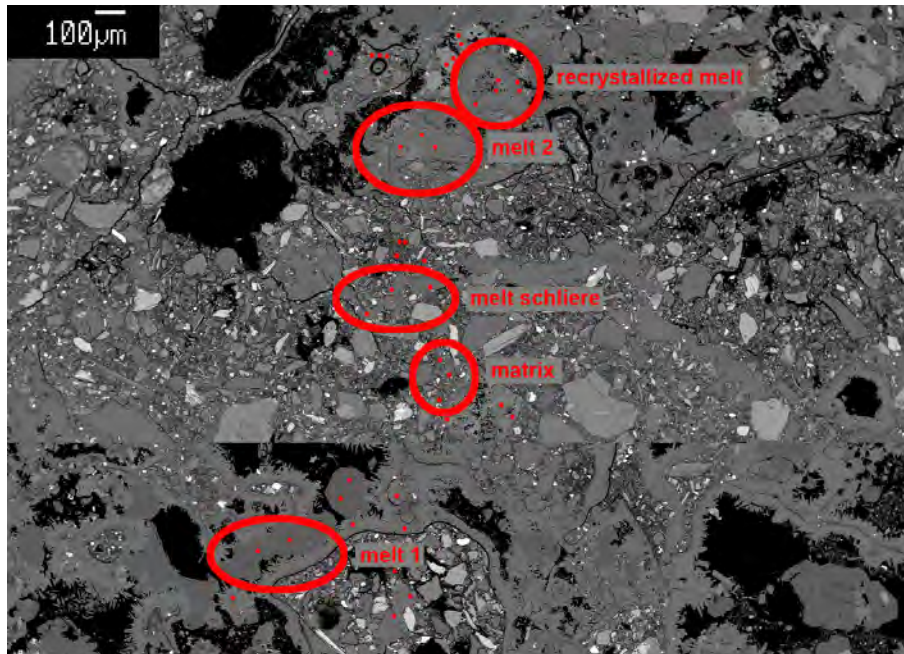


Fig. E.7.: FBN73: Points of EMPA measurements of melt particles and suevite matrix drawn in BSE images. 378.5 m depth.



Fig. E.8.: FBN73: Points of EMPA measurements of melt particles and suevite matrix drawn in BSE images. 380-602 m depth.

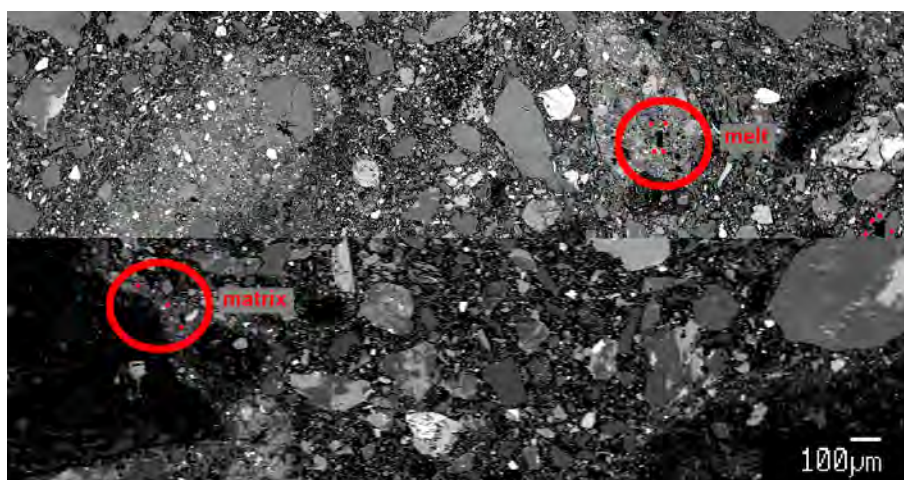


Fig. E.9.: FBN73: Points of EMPA measurements of melt particles and suevite matrix drawn in BSE images. 642.3 m depth.

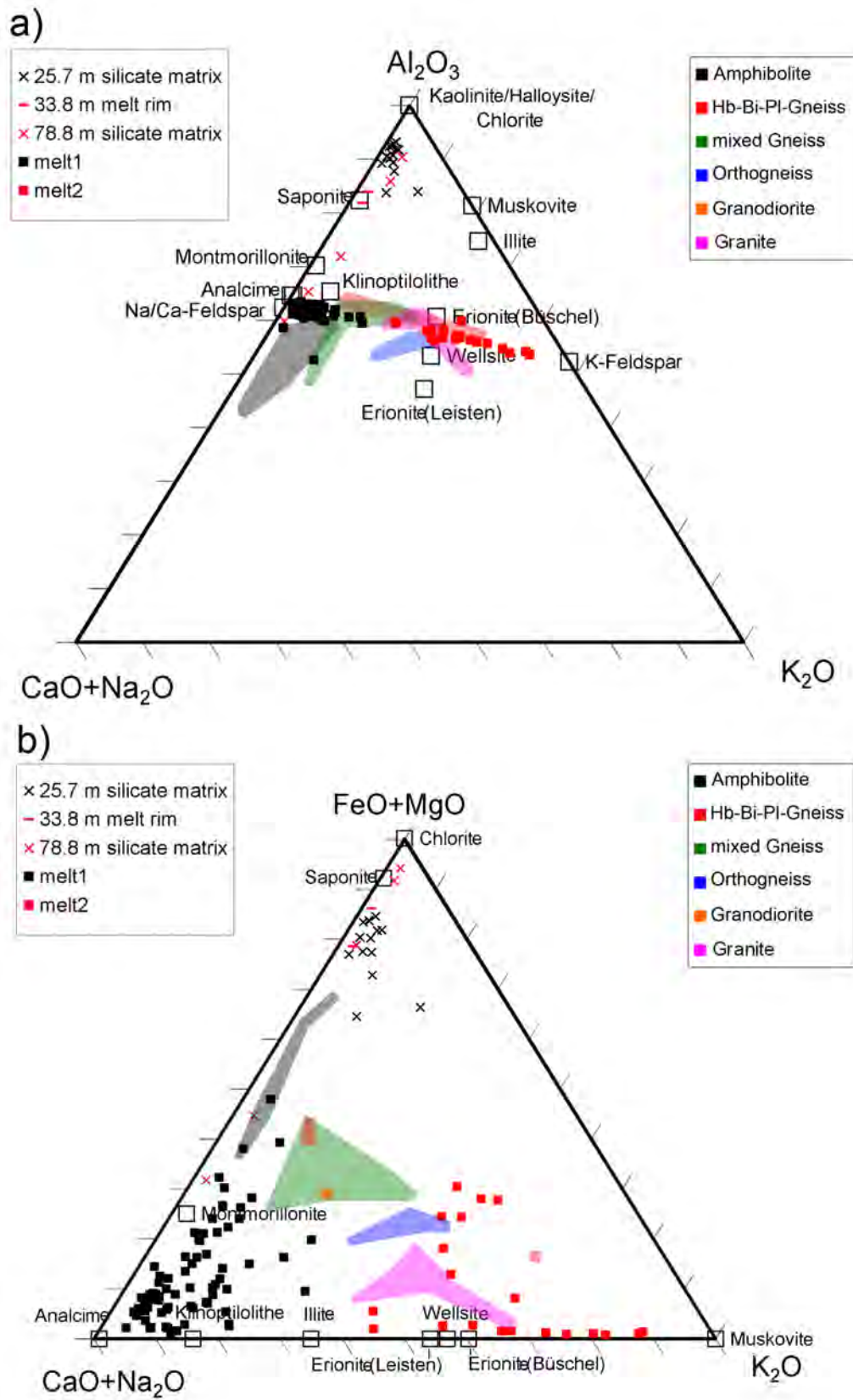


Fig. E.10.: Enkingen: a) Al₂O₃ (A) –CaO+Na₂O (CN) –K₂O (K) diagram; b) FeO+MgO (FM) –CaO+Na₂O (CN) –K₂O (K) diagram.

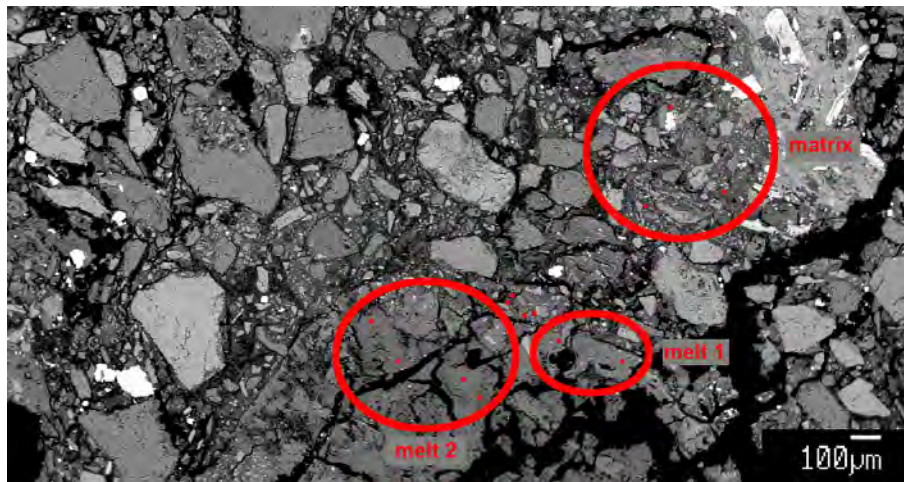


Fig. E.11.: Enkingen: Points of EMPA measurements of melt particles and suevite matrix drawn in BSE images: 25.7 m depth.

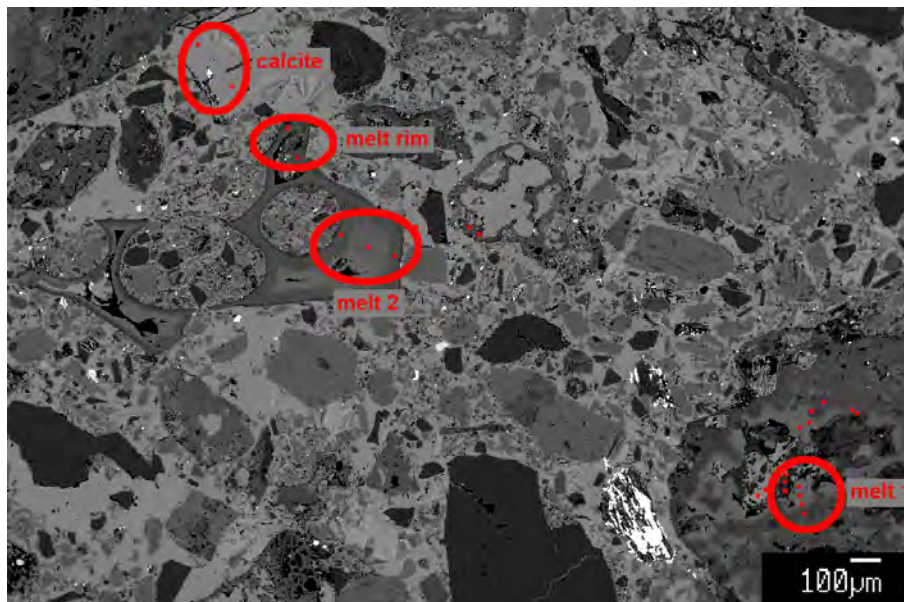


Fig. E.12.: Enkingen: Points of EMPA measurements of melt particles and suevite matrix drawn in BSE images: 33.8 m depth.

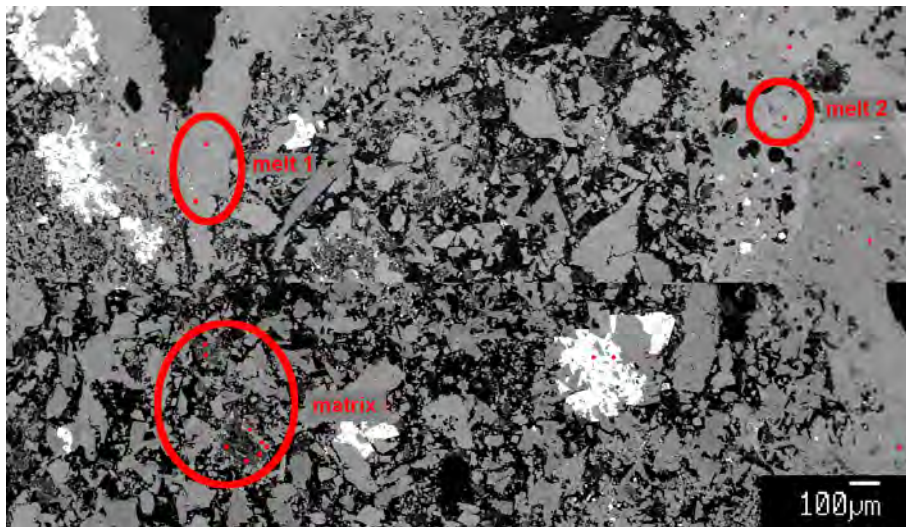


Fig. E.13.: Enkingen: Points of EMPA measurements of melt particles and suevite matrix drawn in BSE images: 78.8 m depth.

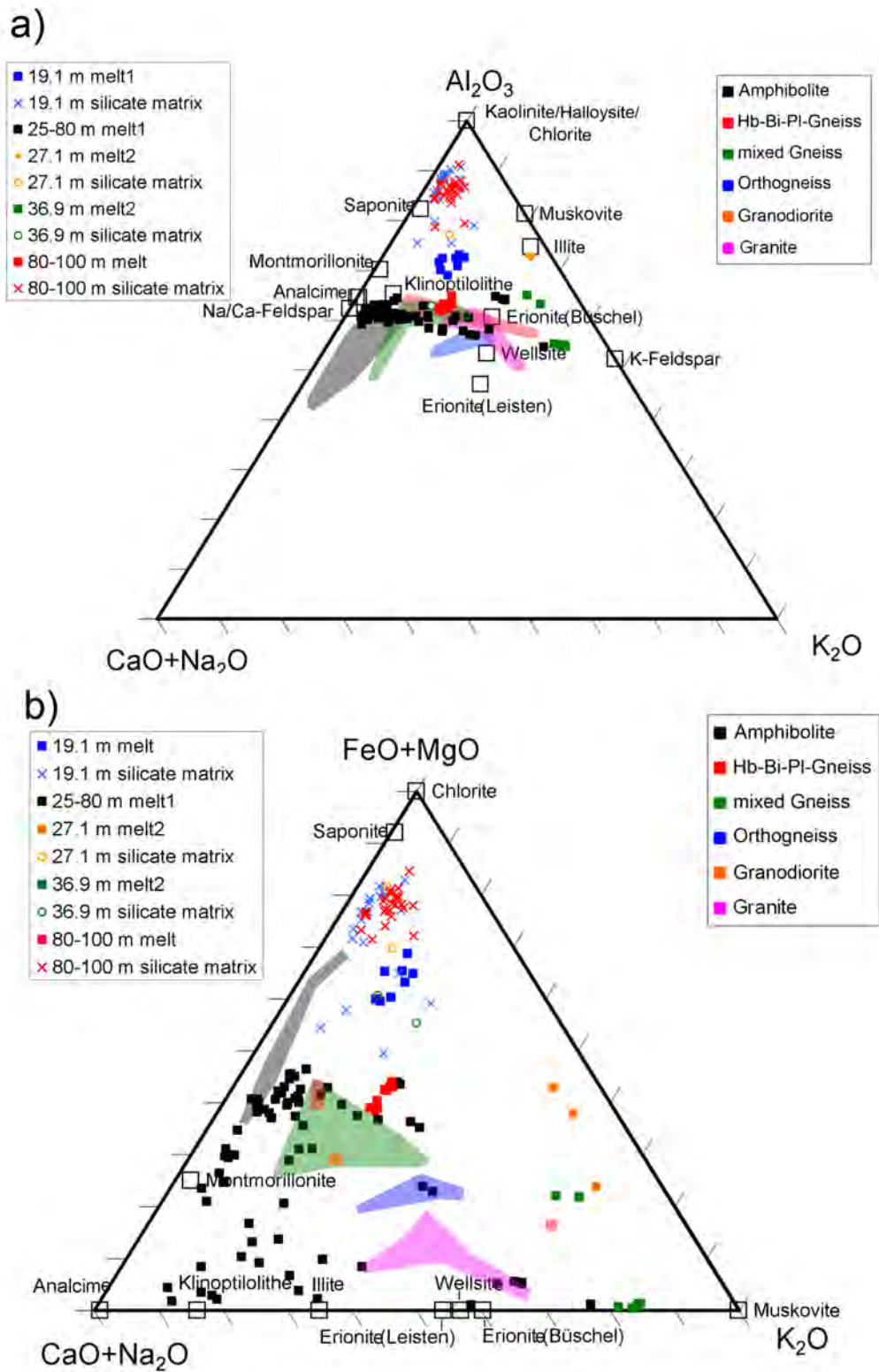


Fig. E.14.: Wörlitzostheim: a) Al_2O_3 (A) – $\text{CaO}+\text{Na}_2\text{O}$ (CN) – K_2O (K) diagram; b) $\text{FeO}+\text{MgO}$ (FM) – $\text{CaO}+\text{Na}_2\text{O}$ (CN) – K_2O (K) diagram.

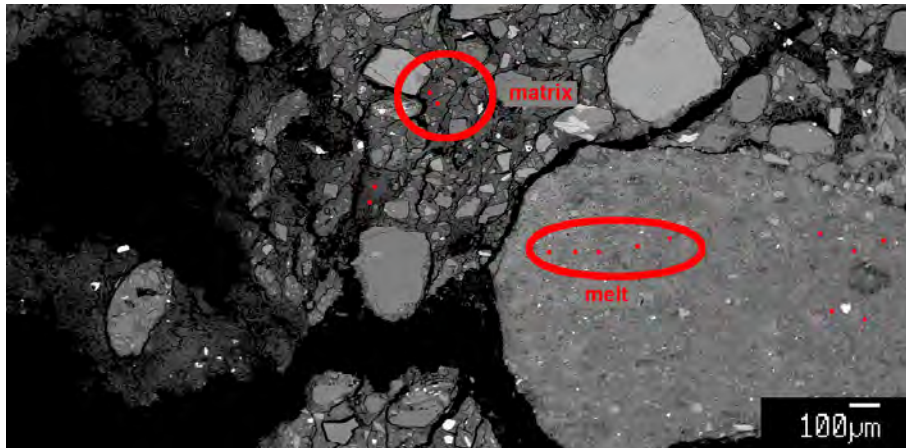


Fig. E.15.: Wörnitzostheim: Points of EMPA measurements of melt particles and suevite matrix drawn in BSE images. 19.1 m depth.

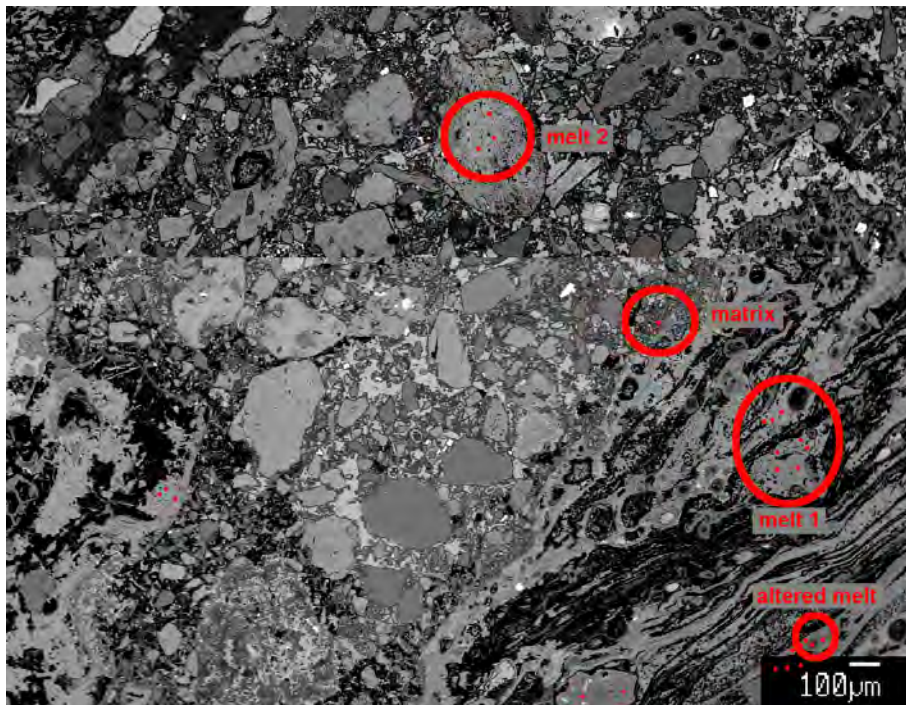


Fig. E.16.: Wörnitzostheim: Points of EMPA measurements of melt particles and suevite matrix drawn in BSE images. 27.1 m depth.

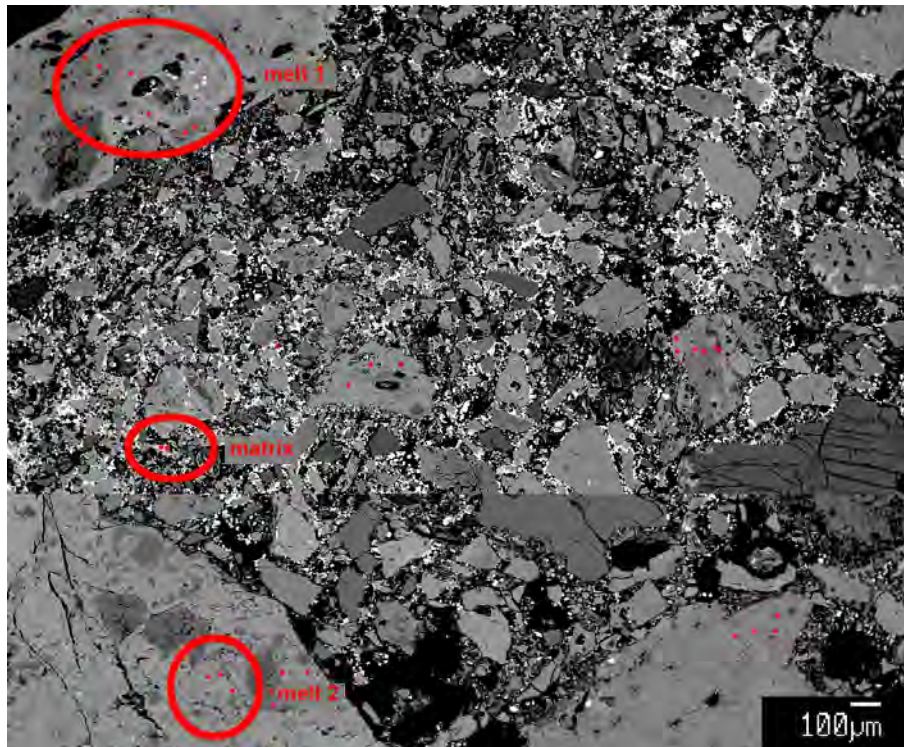


Fig. E.17.: Wörnitzostheim: Points of EMPA measurements of melt particles and suevite matrix drawn in BSE images. 36.9 m depth.



Fig. E.18.: Wörnitzostheim: Points of EMPA measurements of melt particles and suevite matrix drawn in BSE images. 95.2 m depth.

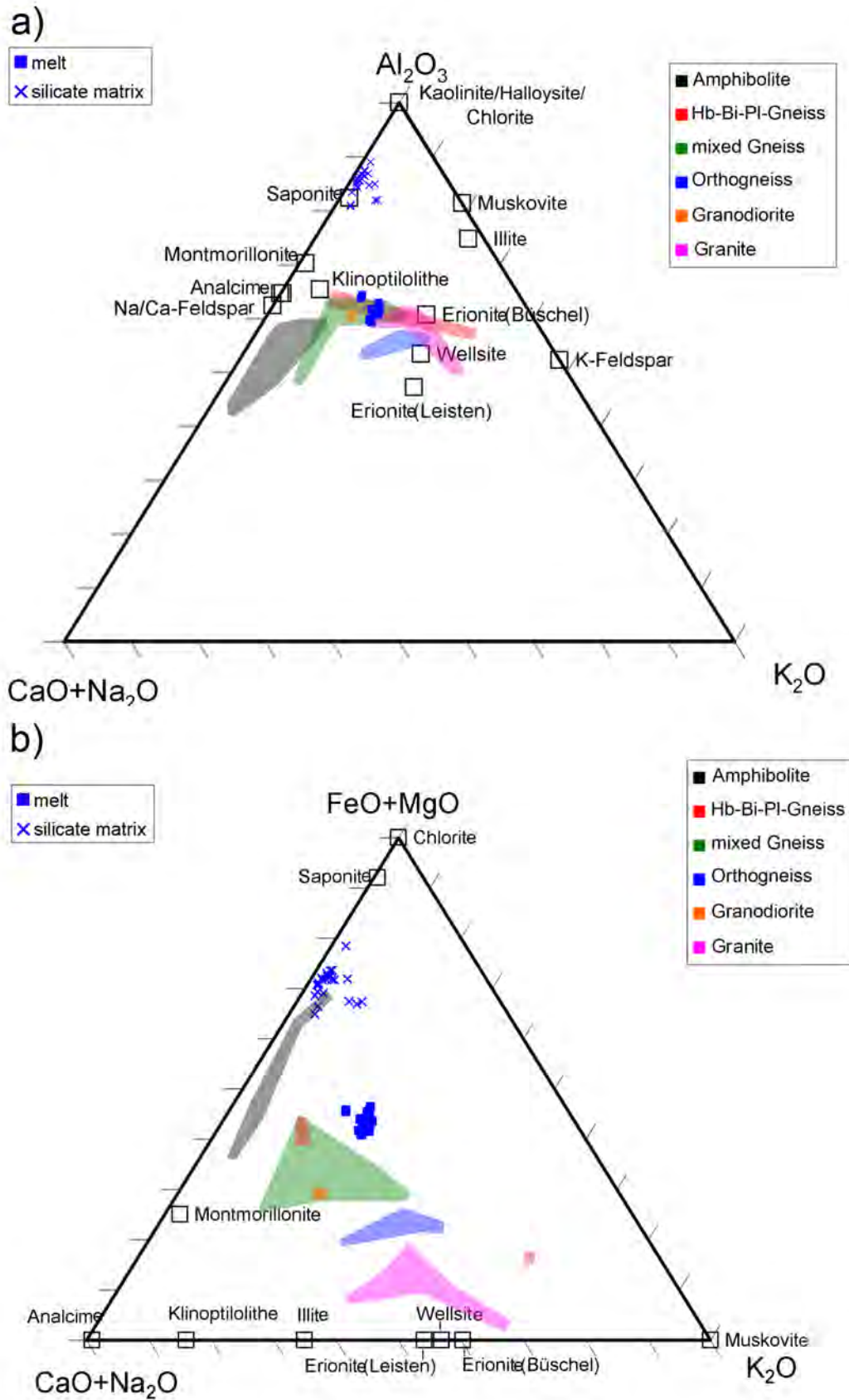


Fig. E.19.: Otting: a) Al_2O_3 (A) – $\text{CaO}+\text{Na}_2\text{O}$ (CN) – K_2O (K) diagram; b) $\text{FeO}+\text{MgO}$ (FM) – $\text{CaO}+\text{Na}_2\text{O}$ (CN) – K_2O (K) diagram.



Fig. E.20.: Otting: Points of EMPA measurements of melt particles and suevite matrix drawn in BSE images. 1.8 m depth.

F. Appendix 6

Isocone diagrams for average analyses of melt particles and suevite matrices, recrystallized melt, melt rims, -veins, and -bubbles of FBN73, Enkingen, Wörnitzostheim, and Otting drill cores. Oxides are plotted in weight%. Isocones are shown according to hypotheses of constant alumina and silica.

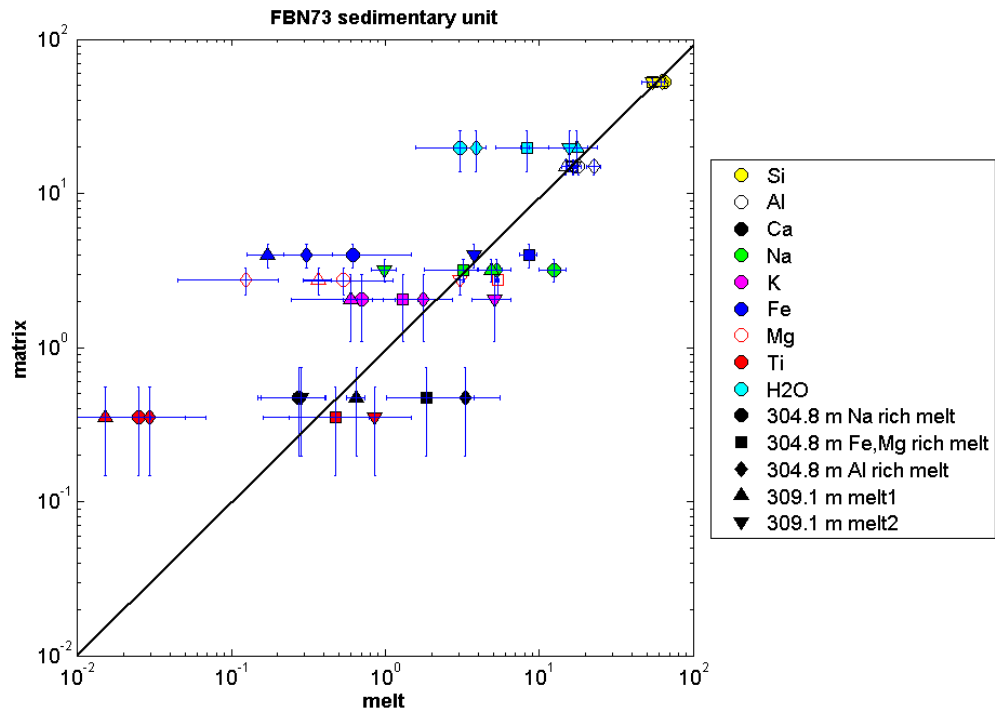


Fig. F.1.: FBN73 sedimentary unit

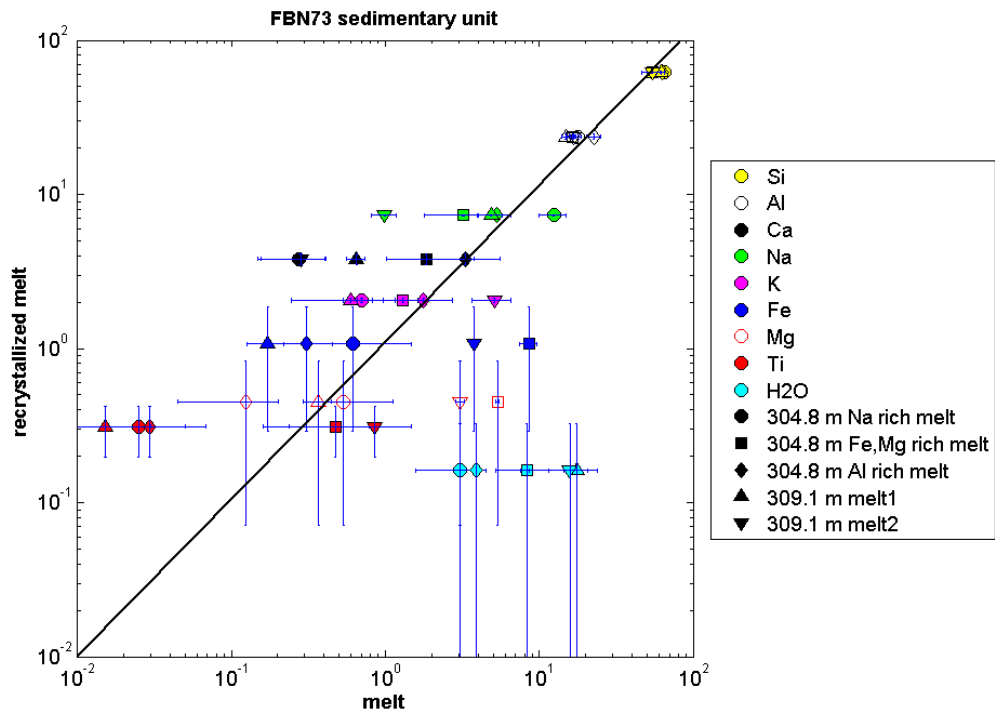


Fig. F.2.: FBN73 sedimentary unit

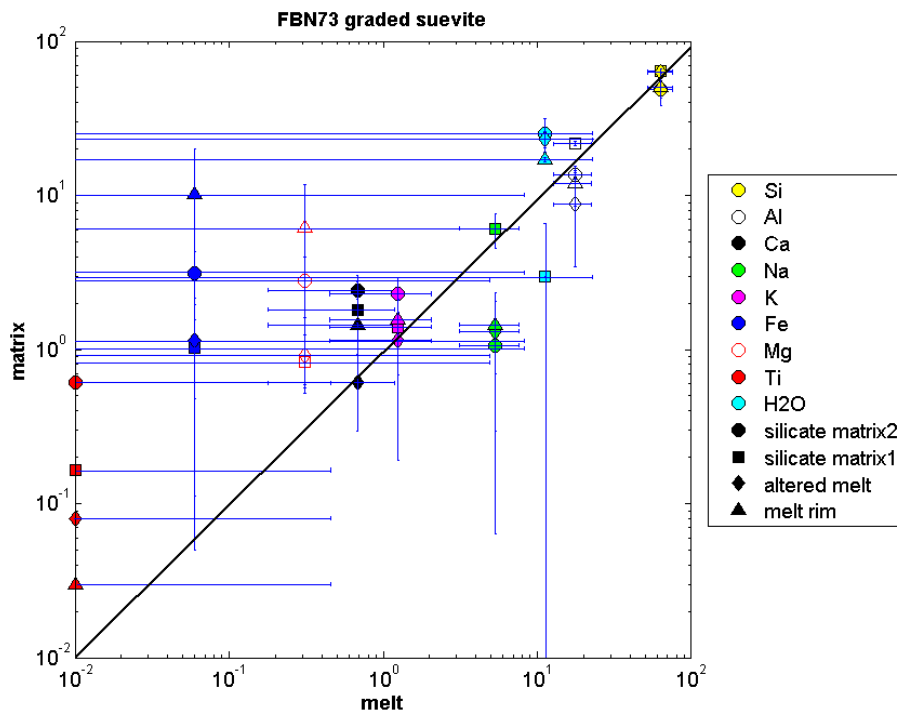


Fig. F.3.: FBN73 graded suevite

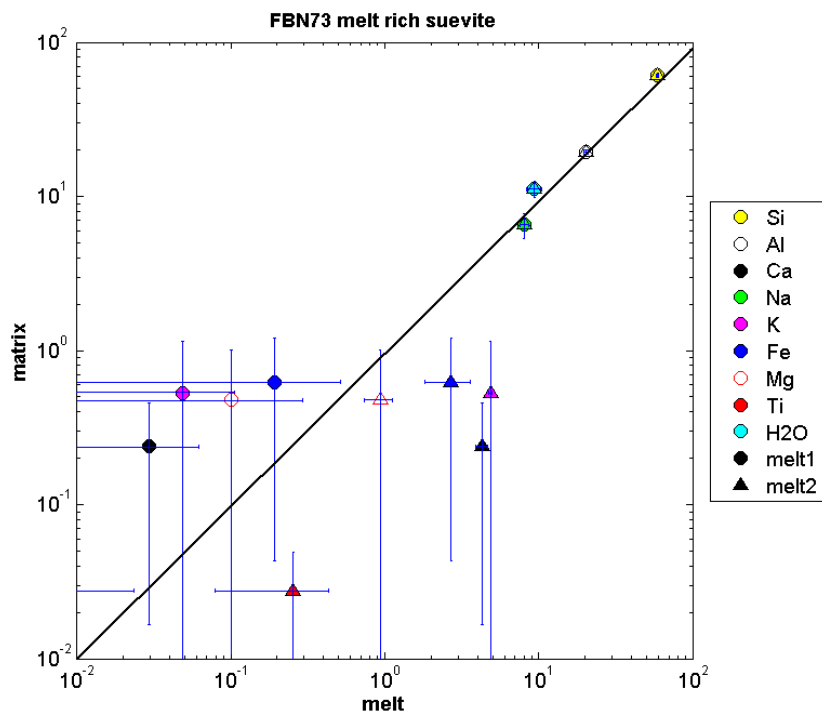


Fig. F.4.: FBN73 melt-rich suevite

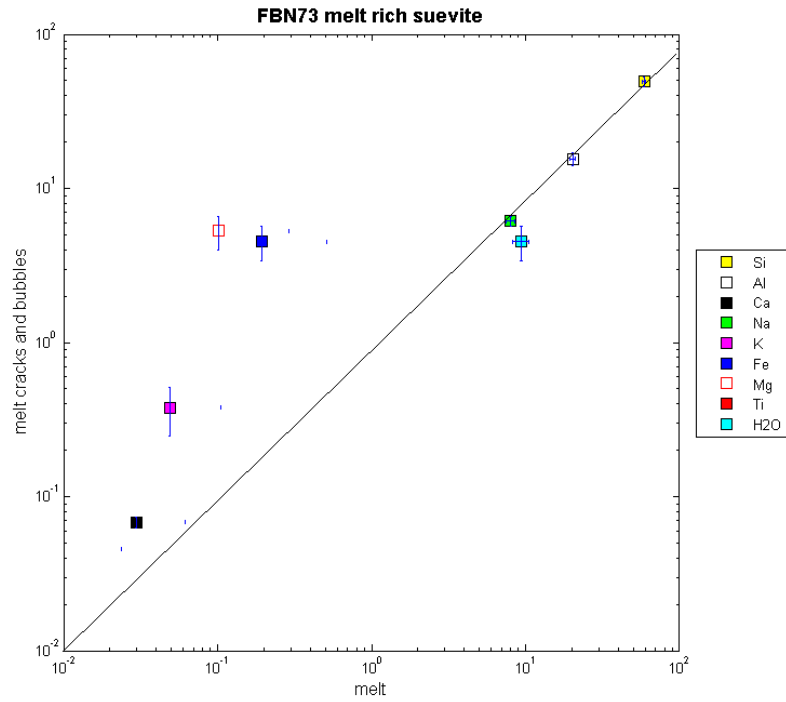


Fig. F.5.: FBN73 melt-rich suevite

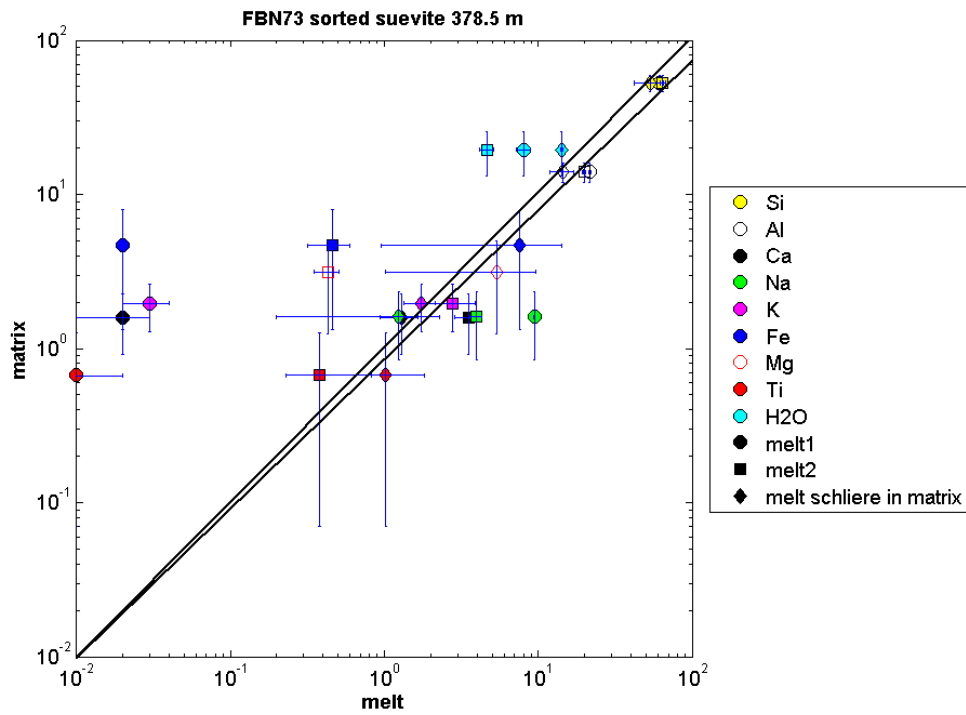


Fig. F.6.: FBN73 sorted suevite 378.5 m

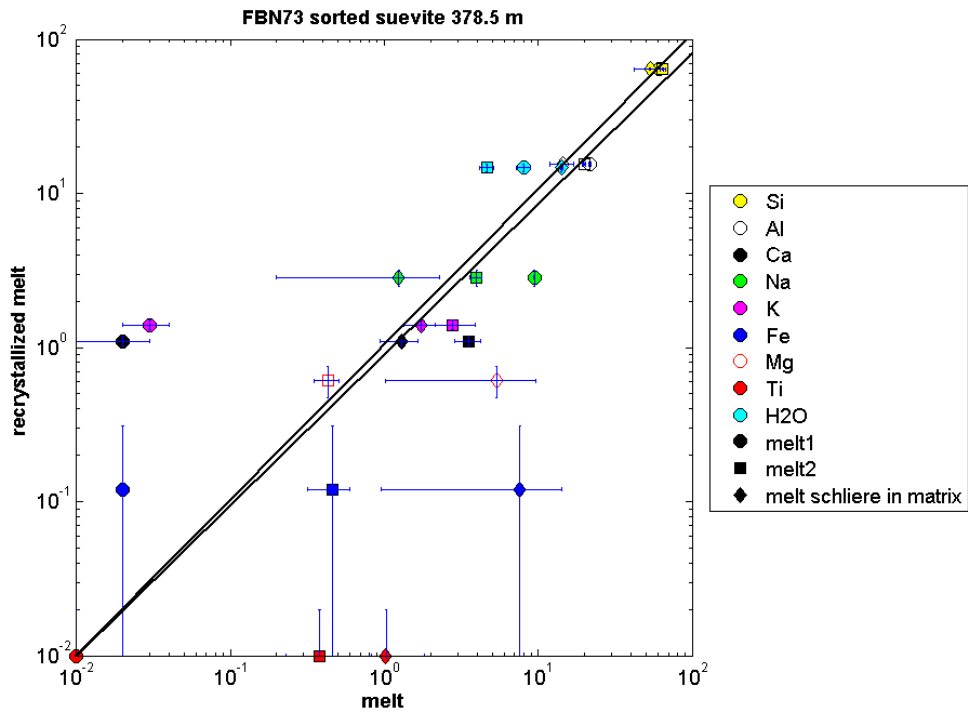


Fig. F.7.: FBN73 sorted suevite 378.5 m

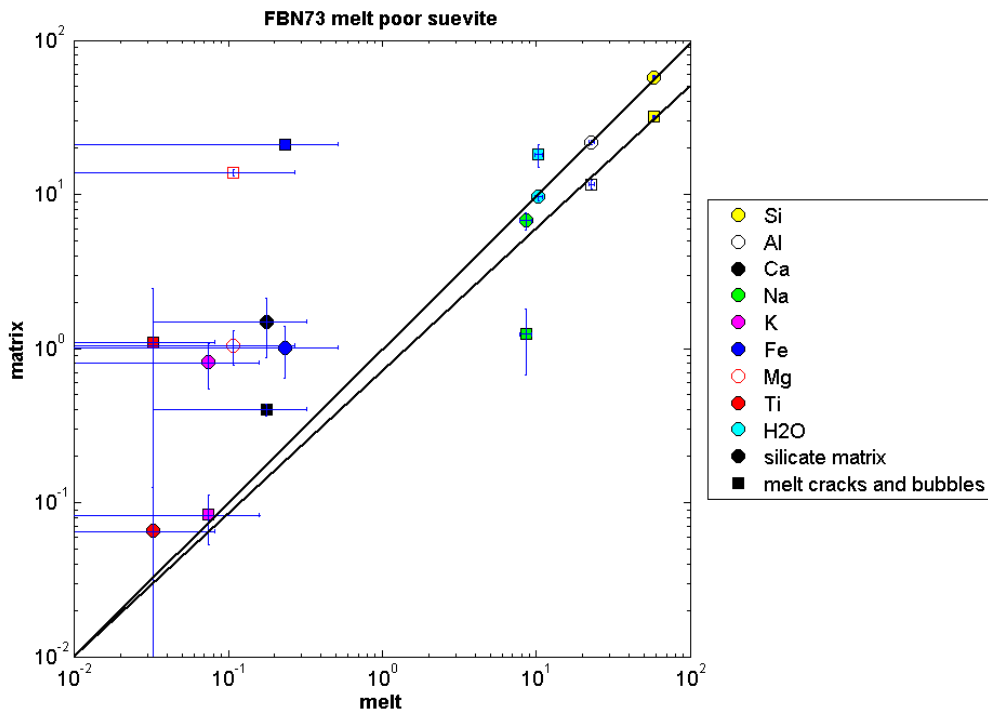


Fig. F.8.: FBN73 melt-poor suevite

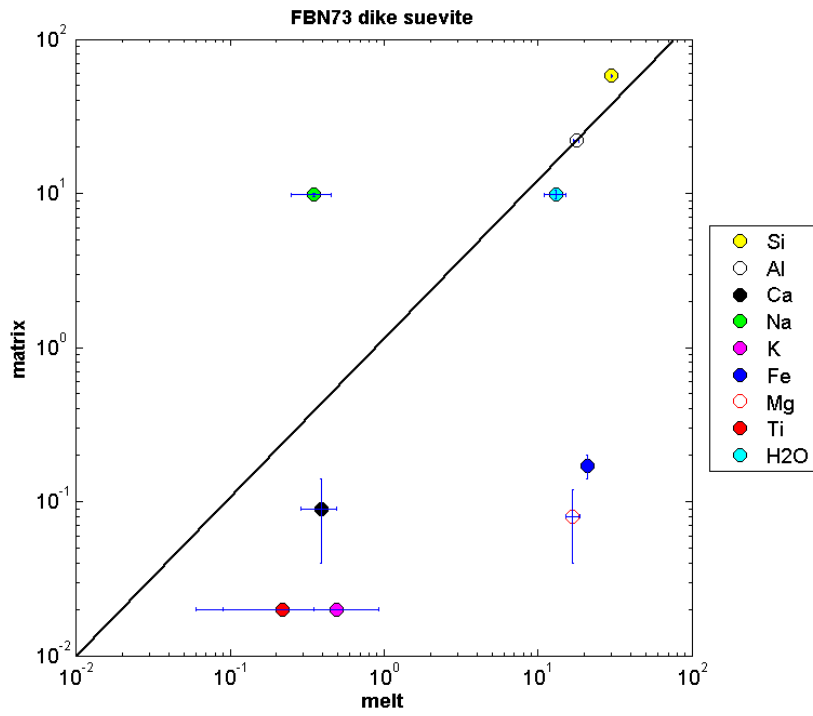


Fig. F.9.: FBN73 dike suevite

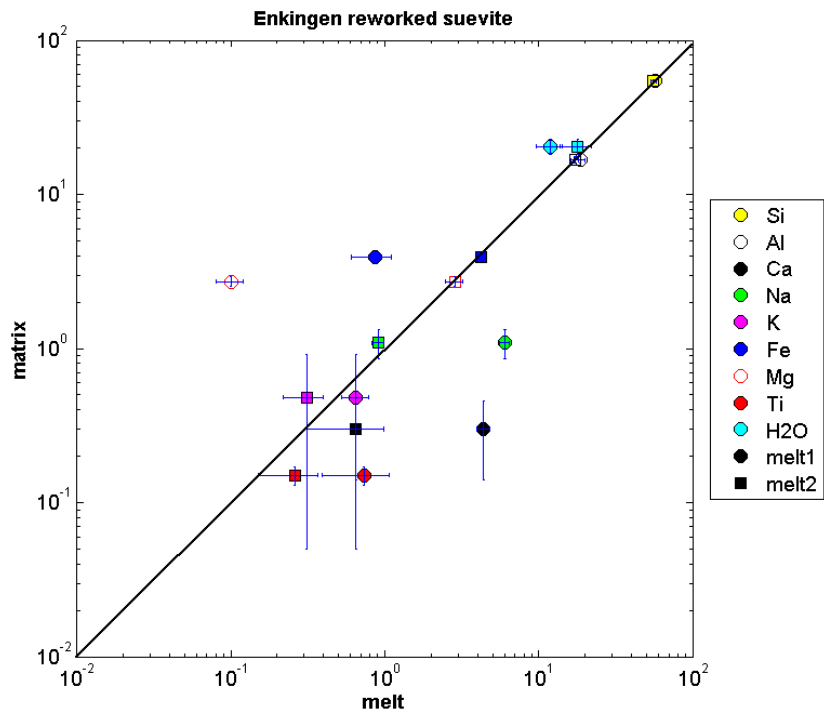


Fig. F.10.: Enkingen reworked suevite

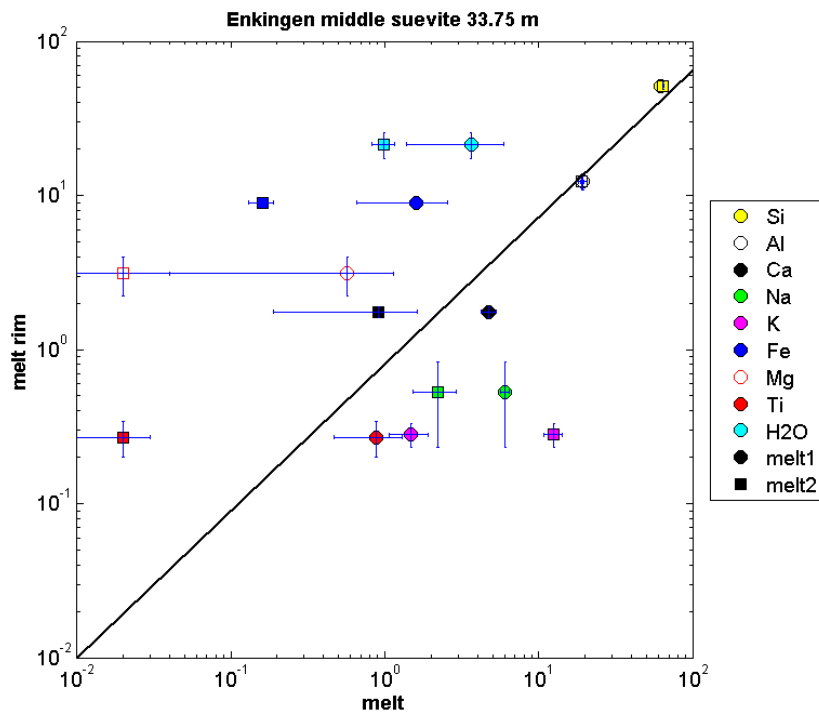


Fig. F.11.: Enkingen middle suevite 33.75 m

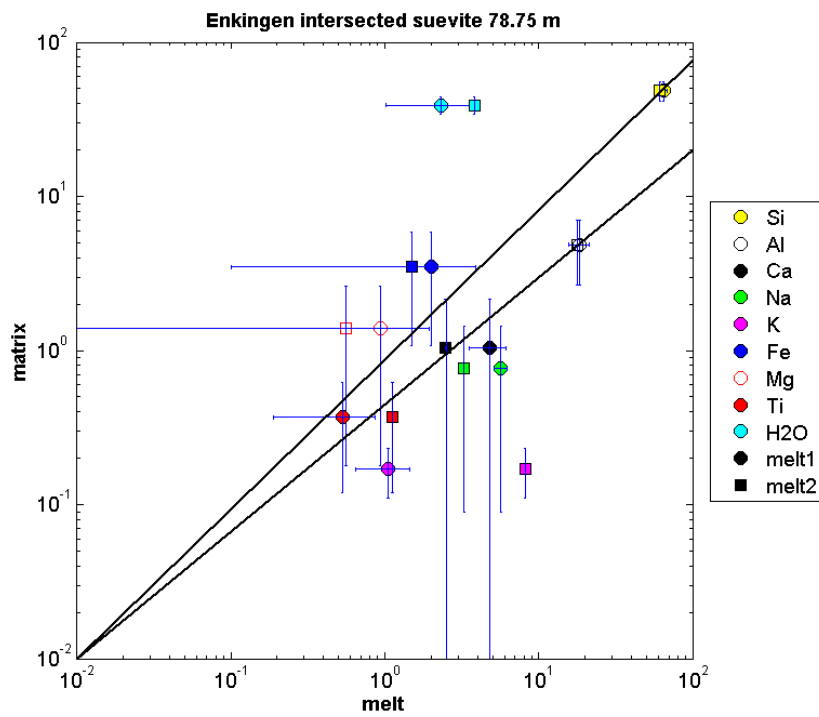


Fig. F.12.: Enkingen intersected suevite 78.75 m

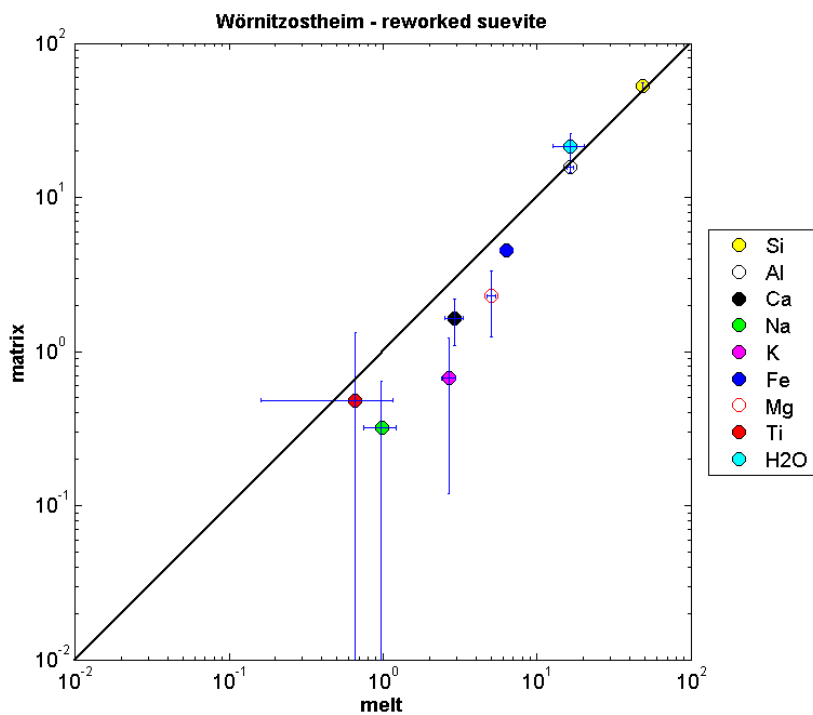


Fig. F.13.: Wörnitzostheim reworked suevite

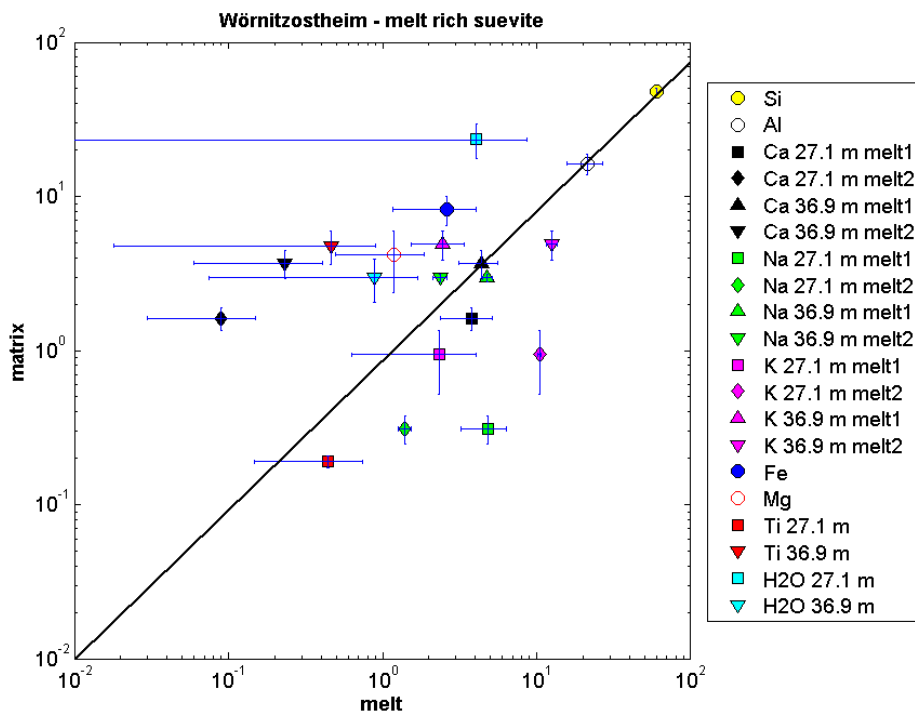


Fig. F.14.: Wörnitzostheim melt-rich suevite

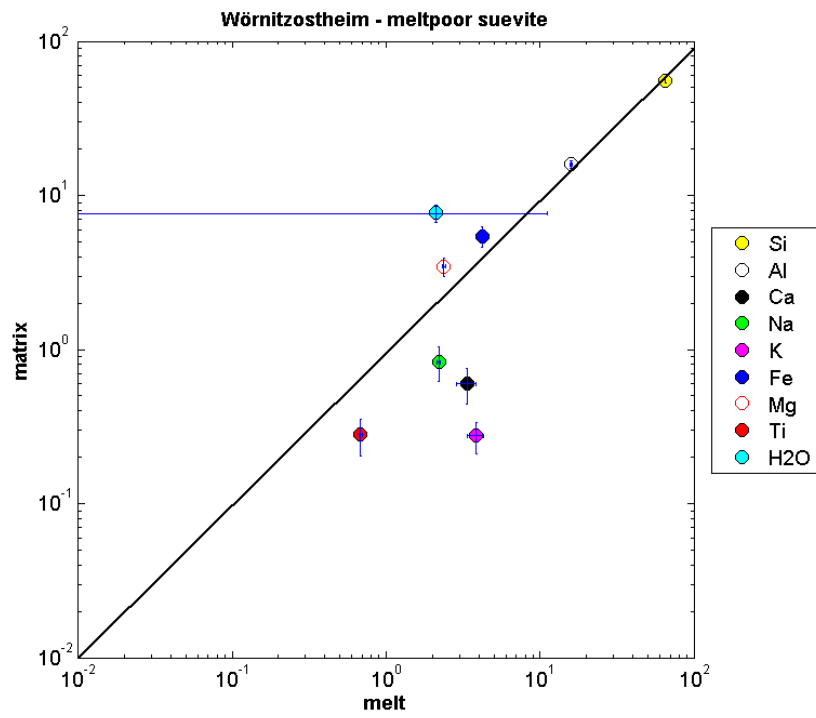


Fig. F.15.: Wörnitzostheim melt-poor suevite

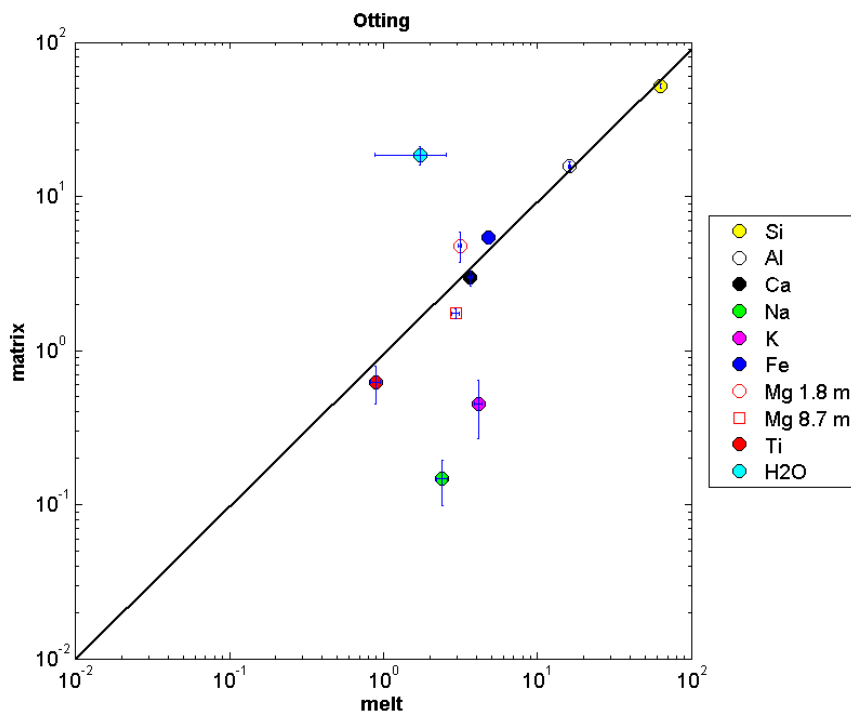


Fig. F.16.: Otting

Danksagung

Die vorliegende Arbeit entstand am Museum für Naturkunde in Berlin im Rahmen des DFG (Deutsche Forschungsgemeinschaft) Projekts "Ejecta Plume of the Ries crater" RE 528/4.

In aller erster Linie und mein meiste Dank gilt meiner Familie, die mich während der letzten Jahre unterstützt, aufgebaut und die ganze Zeit an mich geglaubt hat. Ihr seid die Besten!

Ein ganz besonderer Dank gilt meinen hochverehrten Lehrern Dieter Stöffler und Michel Jébrak, die mich in die Geheimnisse des Suevits und der Brekkzien eingeweiht und mich durch deren Irrwege geführt haben und Stephan van Gasselt, der mich so bereitwillig in die Liste seiner Doktoranden aufgenommen hat. Insbesondere danke ich auch Ulrich Riller für die fruchtbaren Diskussionen, aufbauenden Worte und Unterstützung an dem GSA Manuskript und Richard Grieve für die Englischkorrektur der Arbeit.

Ich danke Jörg Fritz, Juliane Jakob, Daniel Lieger, Tobias Salge und Axel Wittmann dafür, phantastische Zimmergenossen gewesen zu sein, Jana Berlin, Andreas Jahn, Tanja Mohr-Westheide, Daniela Nowka und Michael Poelchau für den Kaffee und Baptist, Raphaél und Jeffrey für die Einführungen in die Unterschiede zwischen Französisch und Québécois.

Ein herzlicher Dank gilt auch den technischen Mitarbeitern und Sekretärinnen Kirsten Born, Peter Czaja, Antje Dittmann, Elke Gerhardt-Mayer, Hwa Ja Götz, Hans-Rudolf Knöfler, Carola Radke, Ulli Raschke, Andreas Schnock, Friedericke Schwarz und den unbekanntenen Herren die unsere Kellerfenster abgedichtet haben.

Für die Geländeunterstützung und hinsichtlich aller Bohrkernbelange danke ich Gisela Pösges, ihrem Mann Ralf und ihrem Hund Joy, der leider von uns gehen musste. Danke auch an die vergnüglichen Stunden im Bayrischen Geologischen Landesamt mit Klaus Poschlod und Jean Pohl an der Spitze.

Weiterhin danke ich u.a. für fachliche Diskussionen: Uwe Altenberger (dafür, dass er mich zum Mineralogiestudium gebracht hat), Natalia Artemieva (für die traumhafte Zeit in Moskau), Elmar Buchner (für die Ignimbrite), Jean-Pierre De Vera (für seinen unglaublichen Ehrgeiz und niemals endenden Optimismus), Daniel Doman (in der Hoffnung, dass er seine Doktorarbeit jemals abgibt), Dirk Elbershausen (für die Einblicke in die 3D Modellierungen und seine ständige gute Laune), Ansgar Greshake (der einen immer wieder in seine Schranken verweist), Lutz Hecht (für die Animation zum dritten Kind), Thomas Kenkmann (für seine

unglaublichen Ideen), Ralf Möller (für seine widerspenstigen Kreaturen), Gordon Osinski (für die Diskussionen zum lateral transportierten Suevit), Uwe Reimold (als Projektleiter), Ralf-Thomas Schmitt (dafür, dass er immer da ist), Frank Schönian (für die Einblicke in die Sedimentologie), Kai Wünnemann (als Projektleiter und dafür, dass er immer ein offenes Ohr hat).

Ich danke meinen Freunden und insbesondere meinem Orchester, die es nie zugelassen haben, mich zum Fachidioten werden zu lassen und Gustav Mahler für seine Weisheit, die absolut übertragbar auf die Wissenschaft ist: "Das Beste in der Musik steht nicht in den Noten."

Curriculum Vitae

For reasons of data protection, the curriculum vitae is not included in the online version

Publikationsliste

Veröffentlicht/akzeptiert:

Meyer, C., Jébrak, M., Stöffler, D., Riller, U. (2011) Lateral transport of suevite inferred from 3D shape fabric analysis: evidence from the Ries impact crater, Germany. *GSA Bulletin*, Vol. 123, 2312-2319.

Meyer, C., Fritz, J., Misgaiski, M., Möller, R., De Vera, J.-P., Cockell, C. S., Rabbow, E., Stöffler, D., Horneck, G., Hornemann, U., Ott, S., Artemieva, N. A. (2011) Shock experiments in support of the Lithopanspermia theory: The influence of host rock composition, temperature and shock pressure on the survival rate of endolithic and epilithic microorganisms. *Meteoritics and Planetary Science*, Vol. 46, No. 5, 701-718.

Fritz, J., Wünnemann, K., Reimold, W.U., **Meyer, C.**, Hornemann, U. (2010) Shock experiments on quartz targets pre-cooled to 77 K. *International Journal of Impact Engineering*, Vol. 38, 440-445.

Pohl, J., Poschod, K., Reimold, U., **Meyer, C.**, Jacob, J. (2010) Ries Crater, Germany: The Enkingen magnetic anomaly and associated drill core SUBO 18. *Large Meteorite Impacts and Planetary Evolution IV. Special Papers (Geological Society of America)*. 465, 141-163

Moeller, R., Horneck, G., Rabbow, E., Reitz, G., **Meyer, C.**, Hornemann, U., Stöffler, D. (2008) Role of DNA Protection and Repair in Resistance of *Bacillus subtilis* Spores to Ultrahigh Shock Pressures Simulating Hypervelocity Impacts. *Applied and Environmental Microbiology*, Vol. 74, No. 21, 6682-6689.

Horneck, G., Stöffler, D., Ott, S., Hornemann, U., Cockell, C.S., Moeller, R., **Meyer, C.**, de Vera, J.P., Fritz, J., Schade, S., Artemieva, N.A. (2008) Microbial Rock Inhabitants Survive Impact and Ejection from Host Planet: First Phase of Lithopanspermia Experimentally Tested. *Astrobiology*, 8 (No. 1), 17-44

Stöffler, D., Horneck, G., Ott, S., Hornemann, U., Cockell, C.S., Moeller, R., **Meyer, C.**, de Vera, J.P., Fritz, J., Artemieva, N.A. (2007) Experimental evidence for the potential impact ejection of viable microorganisms from Mars and Mars-like planets. *Icarus*, 186, 585-588

Populärwissenschaftliche Veröffentlichungen:

Cornelia Meyer: Leben zwischen den Planeten. Tagesspiegel, 15. April 2007

Cornelia Meyer (2008) Is there anybody out there? An ark of life. Science in School. Issue 9: Autumn 2008

Bücher:

Bernd Zöllner und **Cornelia Meyer**: Mathematik zur Vorbereitung auf die Fachhochschulreife
Wirtschaft - Teil 1: Zahlen, Mengen, Terme, Gleichungen, Ungleichungen und Funktionen.
In final correction.

Selbstständigkeitserklärung

Hiermit erkläre ich, dass ich die vorliegende Arbeit selbständig und nur unter Verwendung der angegebenen Literatur und Hilfsmittel angefertigt habe. Die aus fremden Quellen direkt oder indirekt übernommenen Inhalte sind im Text und den Abbildungen entsprechend gekennzeichnet. Die Personen die mir fachlich beratend und betreuend beiseite gestanden haben, und jene die an der Fertigstellung dieser Arbeit mitgewirkt haben sind in der Danksagung am Ende der Arbeit erwähnt.

Berlin, den 4.3.2011 Cornelia Meyer