Appendix A. Presentation and Analysis of Sedflume Data

A.1 Determining Erosion Rate Model Parameters from Sedflume Data

A total of 19 Sedflume cores were collected during the field study that was conducted during December 2004. One core (Sf-5) contained sandy sediment and is excluded from this analysis. The erosion rate properties of the remaining 18 cores, which are composed of cohesive sediment, were analyzed using the following procedure. Each core was divided into 5-cm thick layers (i.e., 0-5, 5-10, 10-15, 15-20, 20-25 cm depth intervals). The erosion rate data within each layer of a particular core were analyzed through application of a log-linear regression analysis between erosion rate and shear stress. The log-linear regression analysis produced values of A and n (see Equation 3-1) for each 5-cm layer in a particular core. The results of this analysis for the Sedflume cores with cohesive sediment are presented in Figures A-1 through A-18. The erosion rate parameters (A and n) for each core within the five depth intervals are listed in Tables A-1 through A-5.

Table A-1. Erosion rate parameters for 0-5 cm layer

Sediment Core ID	Erosion Rate Parameter A (x 10^{-4})	Erosion Rate Exponent n	Correlation Coefficient (R^2)
Sf-1	3.8	3.0	0.99
Sf-2	8.8	1.7	0.83
Sf-3	89	2.2	0.88
Sf-4	23	2.1	0.97
Sf-6-R1	24	2.8	0.99
Sf-6-R2	35	2.2	0.98
Sf-7	19	1.5	0.99
Sf-8	21	1.5	0.91
Sf-9	15	0.96	0.79
Sf-10	22	1.5	0.90
Sf-11	19	1.4	0.82
Sf-12	6.5	3.9	0.98
Sf-13	11	1.3	0.98
Sf-14	80	2.3	0.94
Sf-15	9.4	1.7	0.91
Sf-16-R1	43	2.7	0.96
Sf-16-R2	29	2.6	0.98
Sf-17	21	3.0	0.97

Table A-2. Erosion rate parameters for 5-10 cm layer

Sediment Core ID	Erosion Rate Parameter A (x 10^{-4})	Erosion Rate Exponent n	Correlation Coefficient (R^2)
Sf-1	0.29	3.5	0.98
Sf-2	1.9	2.0	0.90
Sf-3	24	3.3	0.85
Sf-4	3.7	2.6	0.89
Sf-6-R1	3.8	3.1	0.98
Sf-6-R2	6.3	2.6	0.98
Sf-7	6.0	1.8	0.95
Sf-8	5.9	2.8	1.0
Sf-9	0.055	3.4	0.81
Sf-10	5.9	2.8	1.0
Sf-11	3.9	3.1	0.91
Sf-12	8.3	3.0	1.0
Sf-13	0.70	2.9	0.97
Sf-14	6.9	1.6	1.0
Sf-15	6.0	2.5	0.94
Sf-16-R1	3.3	2.9	0.99
Sf-16-R2	4.7	2.6	0.98
Sf-17	25	2.6	1.0

Table A-3. Erosion rate parameters for 10-15 cm layer

Sediment Core ID	Erosion Rate Parameter A (x 10^{-4})	Erosion Rate Exponent n	Correlation Coefficient (R^2)
Sf-1	5.3	0.3	0.041
Sf-2	0.19	2.9	0.96
Sf-3	12	2.7	0.96
Sf-4	0.74	3.3	1.0
Sf-6-R1	0.70	3.2	1.0
Sf-6-R2	4.3	3.0	0.96
Sf-7	11	2.0	0.98
Sf-8	8.2	2.1	0.99
Sf-9	24	2.3	0.94
Sf-10	8.3	3.7	1.0
Sf-11	0.51	3.5	0.90
Sf-12	6.1	2.1	1.0
Sf-13	0.43	5.2	1.0

Sediment Core ID	Erosion Rate Parameter A (x 10^{-4})	Erosion Rate Exponent n	Correlation Coefficient (R^2)
Sf-14	0.35	2.8	0.99
Sf-15	0.097	3.5	0.97
Sf-16-R1	15	2.6	0.98
Sf-16-R2	5.3	0.3	0.041
Sf-17	0.19	2.9	0.96

Table A-4. Erosion rate parameters for 15-20 cm layer

Sediment Core ID	Erosion Rate Parameter A (x 10^{-4})	Erosion Rate Exponent n	Correlation Coefficient (R^2)
Sf-1	3.8	3.0	0.99
Sf-2	9.2	1.3	1.0
Sf-3	16	2.2	1.0
Sf-4	0.55	3.1	0.98
Sf-6-R1	2.9	2.1	1.0
Sf-6-R2	0.27	3.7	1.0
Sf-7	1.8	3.0	0.86
Sf-8	0.14	3.0	0.88
Sf-9	0.029	3.2	0.87
Sf-10	0.083	3.5	0.64
Sf-11	9.4	1.4	0.97
Sf-12	7.5	3.4	1.0
Sf-13	0.095	3.7	0.98
Sf-14	1.6	2.2	0.93
Sf-15	0.88	2.1	1.0
Sf-16-R1	5.1	3.5	0.99
Sf-16-R2	3.8	3.0	0.99
Sf-17	9.2	1.3	1.0

Table A-5. Erosion rate parameters for 20-25 cm layer

Sediment Core ID	Erosion Rate Parameter A (x 10^{-4})	Erosion Rate Exponent n	Correlation Coefficient (R^2)
Sf-1	0.13	2.7	1.0
Sf-2	0.51	3.1	0.8
Sf-3	29	1.8	0.77
Sf-4	0.03	5.0	0.84
Sf-6-R1	1.4	2.5	0.99
Sf-6-R2	0.62	3.1	0.96
Sf-7	0.35	3.6	1.0
Sf-8	0.023	4.2	1.0
Sf-9	0.0	6.7	0.98
Sf-10	0.0083	4.7	1.0
Sf-11	0.097	3.2	0.97
Sf-12	8.0	3.3	0.99
Sf-13	0.96	3.1	0.99
Sf-14	2.5	1.8	1.0
Sf-15	240	-0.53	0.28
Sf-16-R1	3.7	1.6	1.0
Sf-16-R2	0.016	4.0	1.0
Sf-17	2.8	2.3	1.0

A.2 Additional Analysis of Sedflume Data

Vertical profiles of wet density for the 19 Sedflume cores are presented in Figures A-19 through A-23. Generally, the profiles of the 18 cohesive (i.e., sandy silt) cores are similar. Vertical variations in wet density in the cohesive cores are relatively small, with a general trend of increasing wet density with increasing depth in the core. This trend is due to consolidation effects and is typical for cohesive (muddy) sediment. The sandy core (Sf-5) has a higher wet density (about 1.8 to 1.9 g/cm) than the cohesive cores. Vertical variation of wet density in core Sf-5 is low, which is typical for sandy sediment.

Particle size variations with depth in the core are shown in Figures A-24 through A-28, with the particle size distribution represented by D_{10}, D_{50}, and D_{90} values. For convenience, actual D_{10} and D_{90} values values were multiplied by 10 and 0.1, respectively, before plotting on these figures. This adjustment of the data allows D_{10}, D_{50}, and D_{90} data to be compared directly. For the cohesive (i.e., sandy silt) cores, particle size tends to generally be relatively uniform with depth, but some cores do exhibit vertical variations in grain size distribution. Median particle diameter (D_{50}) is less than 100 μm in the cohesive cores, while D_{50} is never more than 1,000 μm (coarse

sand). For the sandy core (Sf-5), D_{50} values range between about 200 and 400 μm (fine to medium sand).

A.3 IMPLICATIONS FOR SEDIMENT TRANSPORT

A.3.1 Core Sf-1

This core was collected in the west bench area near RM 0.5. An increase in wet density occurs at about 10 cm in the core (Figure A-19). Relatively small increases in D_{50} and D_{90} occur at this depth, but the D_{50} values vary over a range of 5 to 15 μm and D_{90} values vary over a range of 50 to 100 μm in this core (Figure A-24). The D_{10} data are approximately constant with depth, with a value of about 2 μm. Even though the data indicate that a discontinuity in wet density exists near 10 cm, the grain size distribution data do not indicate that this discontinuity corresponds to the effects of bed disturbance (e.g., episodic erosion/deposition event).

A.3.2 Core Sf-2

This core was collected in the shallow channel to the west of Kellogg Island, near RM 0.7. Wet density is relatively low at the surface (about 1.38 g/cm^3), and is approximately constant below 5 cm depth, with a value of about 1.65 g/cm^3 (Figure A-19). Particle size distribution (i.e., D_{50}, D_{90}) tends to increase with depth for the coarser fraction (Figure A-24). D_{50} values increase from about 25 μm at the surface to about 40 μm at 15 cm in the core. The D_{10} data are approximately constant with depth, with a value of about 3 μm. These patterns indicate that slightly coarser sediment was deposited in the past at this location, which suggests that temporal changes have occurred in the composition of sediment transported to and deposited at this location.

A.3.3 Core Sf-3

This core was obtained in the east bench area near RM 1.2. An increase in wet density occurs at a depth between 1 and 7 cm, followed by a decrease to an approximately constant value of 1.43 g/cm^3 (Figure A-19). Particle size distribution is approximately constant with depth, except for D_{90}, which has a relatively high value at about 7 cm depth (Figure A-24). These trends suggest that a bed disturbance (e.g., episodic erosion/deposition event) occurred at this location in the past.

A.3.4 Core Sf-4

This core was collected in the east bench area near RM 1.4. A relatively large increase in wet density (from about 1.5 g/cm^3 to over 1.6 g/cm^3) occurs between 5 and 10 cm in the core, followed by a decrease to about 1.5 g/cm^3 at approximately 20 cm depth (Figure A-19). Relatively high variability in particle size distribution is observed in this core (Figure A-24). These trends suggest that one or more bed disturbances (e.g., episodic erosion/deposition event) occurred at this location in the past.

A.3.5 Core Sf-5

This core was collected in the west bench area near RM 2.0. This core is the only Sedflume core classified as silty sand (i.e., noncohesive sediment). Bed properties (wet density and particle size) are also approximately uniform within the core (Figures A-20 and A-25). These data provide no evidence of past bed disturbances at this location.

A.3.6 Core Sf-6-R1

This core was collected near RM 2.3, within the west bench area. Wet density increases with depth in the core, from about 1.35 g/cm^3 at the surface to about 1.55 g/cm^3 below 20 cm (Figure A-20). Particle size distribution is approximately uniform with depth (Figure A-25). D_{50} values vary over a range of 20 to 30 μm and D_{90} values vary over a range of 180 to 200 μm in this core. While variability in bed properties occurs in this core, these data provide no evidence of past bed disturbances at a specific depth in the core.

A.3.7 Core Sf-6-R2

This core was collected in the immediate vicinity of core Sf-6-R1. Wet density is approximately constant (1.35 g/cm^3) in the top 5 cm, followed by a sharp increase to 1.55 g/cm^3 at 10 cm, which remains approximately constant in deeper sediment (Figure A-20). Particle size distribution is variable in this core(Figure A-25), but sediments tend to become finer (e.g., D_{50} decreasing) with increasing depth in the core. These trends suggest that one or more bed disturbances (e.g., episodic erosion/deposition event) occurred at this location in the past.

A.3.8 Core Sf-7

This core was collected within the west bench area near RM 2.7. Wet density increases in the top 5 cm, is approximately constant to 10 cm depth, and then is variable below 10 cm (Figure A-20). An increase in particle size occurs at 15 cm depth, which corresponds to an increase in wet density (Figure A-25). These vertical profiles suggest that a bed disturbance (e.g., episodic erosion/deposition event) occurred at this location in the past.

A.3.9 Core Sf-8

This core was obtained near RM 3.5, within the east bench area. Wet density increases with depth in the core, with a sharp increase at about 15 cm, with a decrease at about 19 cm (Figure A-21). Particle size distribution is variable, with maximum values of D_{50} and D_{90} occurring at the surface of the core (Figure A-26). These vertical profiles suggest that a bed disturbance (e.g., episodic erosion/deposition event) occurred at this location in the past.

A.3.10 Core Sf-9

This core was collected in the west bench area near RM 3.6. Wet density is variable in the top 10 cm, with a general trend of increasing values with increasing depth; minimum wet density occurs at about 18 cm (Figure A-21). Particle size distribution is variable in the top 10 cm, with the minimum D_{50} and D_{90} occurring at about 18 cm, which corresponds to the minimum wet density (Figure A-26). These vertical profiles suggest that a bed disturbance (e.g., episodic erosion/deposition event) occurred at this location in the past.

A.3.11 Core Sf-10

This core was collected in the east bench area near RM 3.6. Wet density increases from a surface value of about 1.32 g/cm^3 to about 1.45 g/cm^3 at 5 cm, and then remains approximately constant deeper in the core (Figure A-21). Particle size distribution increases from 0 to 5 cm depth, and then tends to decrease with increasing depth (Figure A-26). These vertical profiles suggest that a bed disturbance (e.g., episodic erosion/deposition event) occurred at this location in the past.

A.3.12 Core Sf-11

This core was obtained in the east bench area near RM 3.9. Maximum wet density (1.7 g/cm^3) occurs at the surface, and it varies between 1.5 and 1.6 g/cm^3 in deeper portions of the core (Figure A-21). Similar to wet density, the maximum D_{50} and D_{90} values occur at the surface of the core (Figure A-26). While variability in bed properties occurs in this core, these data provide no evidence of past bed disturbances at a specific depth in the core.

A.3.13 Core Sf-12

This core was collected near RM 4.3, within the west bench area. Wet density tends to increase with increasing depth, from about 1.2 to 1.4 g/cm^3 (FigureA-22). Particle size distribution is variable, with maximum D_{50} and D_{90} values occurring at about 10 cm depth (Figure A-27). While variability in bed properties occurs in this core, these data provide no evidence of past bed disturbances at a specific depth in the core.

A.3.14 Core Sf-13

his core was collected in the east bench area near RM 4.4. Wet density increases from about 1.30 to 1.55 g/cm^3 between 0 and 10 cm, decreases to about 1.35 g/cm^3 at 15 cm, and then increases to 1.55 g/cm^3 at 20 cm (Figure A-22). Particle size distribution is relatively uniform with depth, except for a maximum value at about 10 cm (Figure A-27). These trends suggest that one or more bed disturbances (e.g., episodic erosion/deposition event) occurred at this location in the past.

A.3.15 Core Sf-14

This core was collected in the navigation channel near RM 3.0. Wet density tends to increase with depth in the core, from about 1.45 g/cm^3 at the surface to a maximum value of about 1.6 g/cm^3 (Figure A-22). D_{50} values vary over a range of about 15 to 30 μm and D_{90} values vary over a range of 100 to 300 μm in this core (Figure A-27). While variability in bed properties occurs in this core, these data provide no evidence of past bed disturbances at a specific depth in the core. However, past disturbances may not be apparent within the sub-sampling interval scale of 5 cm used in this study.

A.3.16 Core Sf-15

This core was obtained from the navigation channel near RM 3.5. Wet density is variable in the top 15 cm, but it tends to increase with increasing depth in the core (Figure A-22). Particle size distribution increases between the surface and 20 cm depth, followed by a decrease at 25 cm (Figure A-27). While variability in bed properties occurs in this core, these data provide no evidence of past bed disturbances at a specific depth in the core. However, this lack of evidence suggests that any past disturbances may not be apparent, particularly at the sub-sampling interval at a depth of less than 5 cm.

A.3.17 Core Sf-16-R1

This core was collected from the navigation channel near RM 3.9. Wet density tends to increase with increasing depth in the core (Figure A-23). Particle size distribution is relatively uniform throughout the core (Figure A-28). These data provide no evidence of past bed disturbances at this location. However, this lack of evidence suggests that any past disturbances may not be apparent, particularly at the sub-sampling interval at a depth of less than 5 cm.

A.3.18 Core Sf-16-R2

This core was collected in the immediate vicinity of core Sf-16-R1. Wet density increases from about 1.32 g/cm^3 at the surface to about 1.40 g/cm^3 at 5 cm, below that depth, it varies between 1.40 and 1.45 g/cm^3 (Figure A-23). Similar to core Sf-16-F1, particle size distribution is relatively uniform in this core (Figure A-28). These data provide no evidence of past bed disturbances at this location. However, this lack of evidence suggests that any past disturbances may not be apparent, particularly at the sub-sampling interval at a depth of less than 5 cm.

A.3.19 Core Sf-17

This core was collected in the navigation channel near RM 4.4. Wet density tends to increase with depth, from about 1.2 g/cm^3 at the surface to a maximum of about 1.3 g/cm^3 near 20 cm (Figure A-23). Particle size distribution is slightly variable, decreasing between the surface and 15 cm, followed by an increase below that point (Figure A-28). These data provide no evidence of past bed disturbances at this

location. However, this lack of evidence suggests that any past disturbances may not be apparent, particularly at the sub-sampling interval at a depth of less than 5 cm.

LIST OF FIGURES CITED IN APPENDIX A

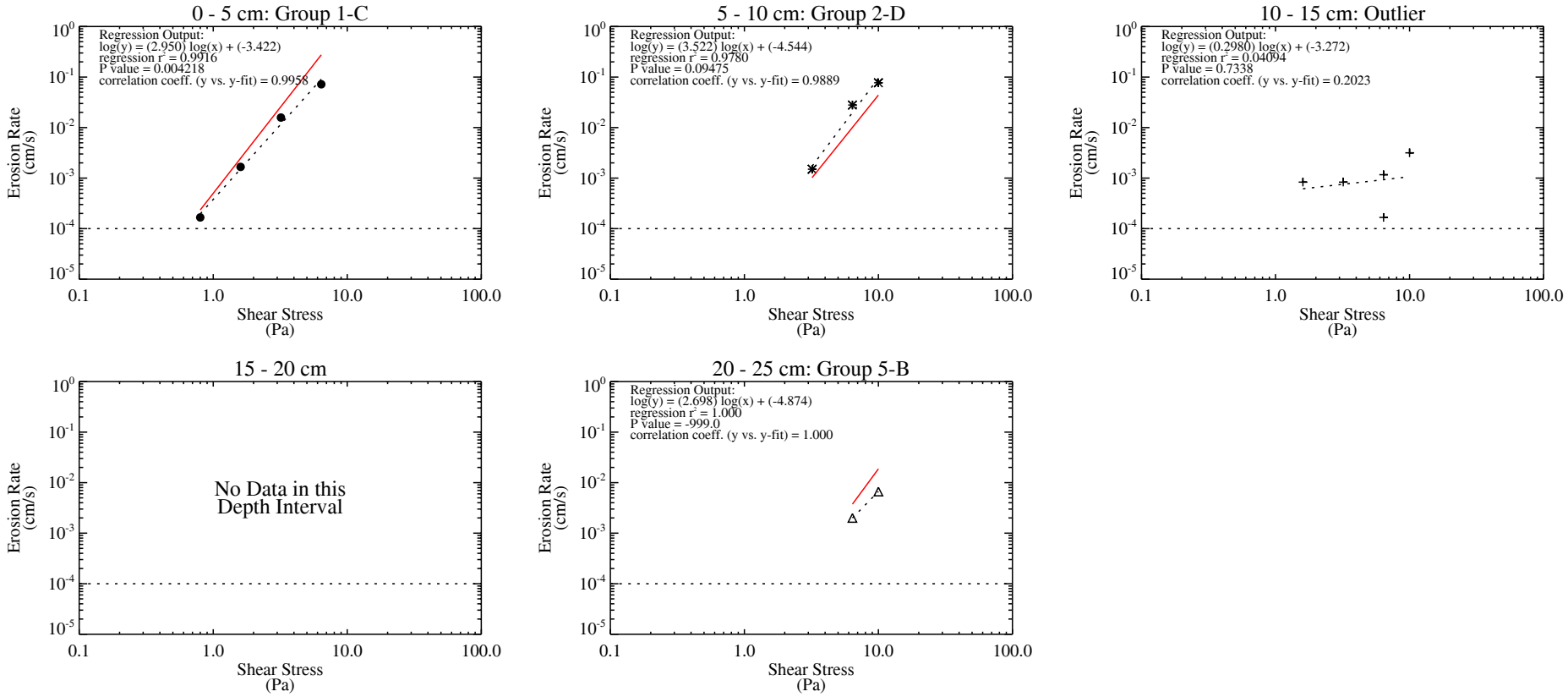

Figure A-1. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-1. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

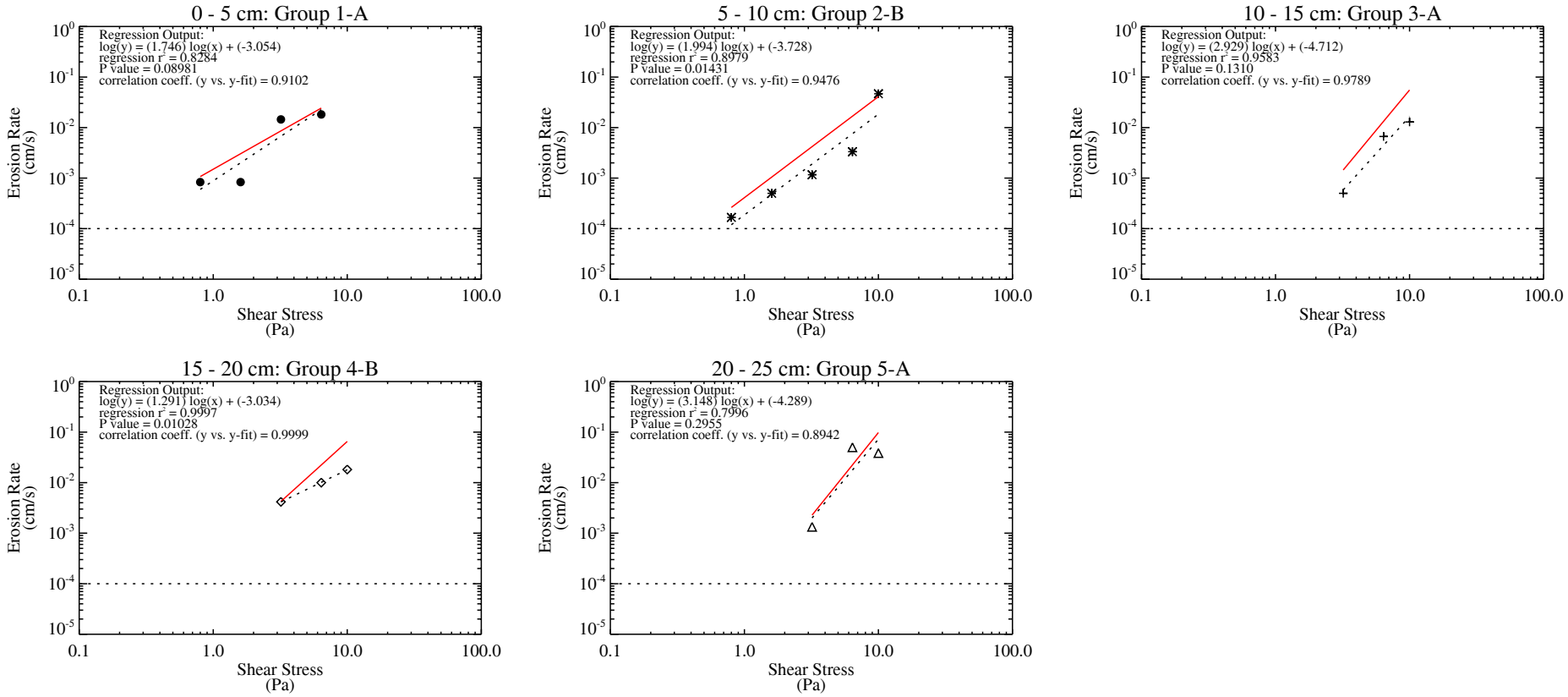

Figure A-2. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-2. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

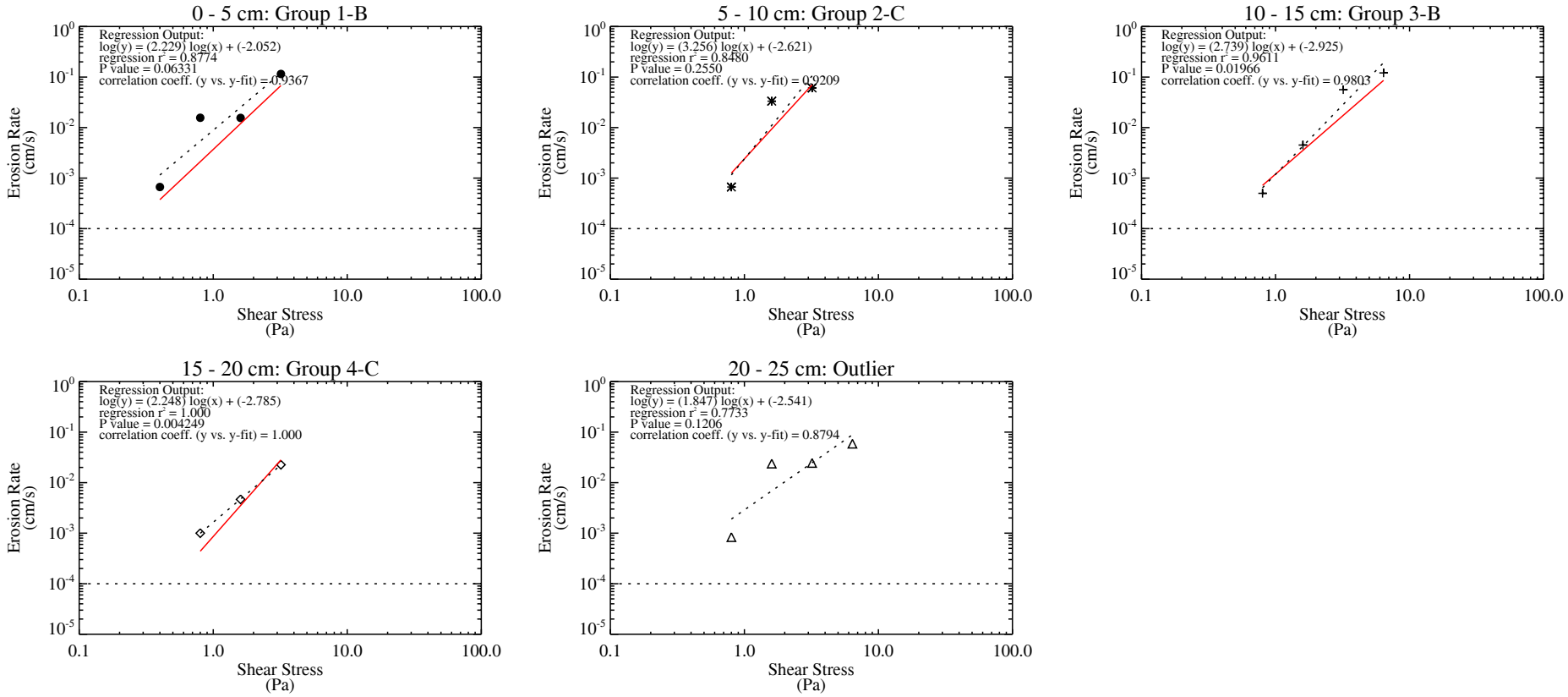

Figure A-3. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-3. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

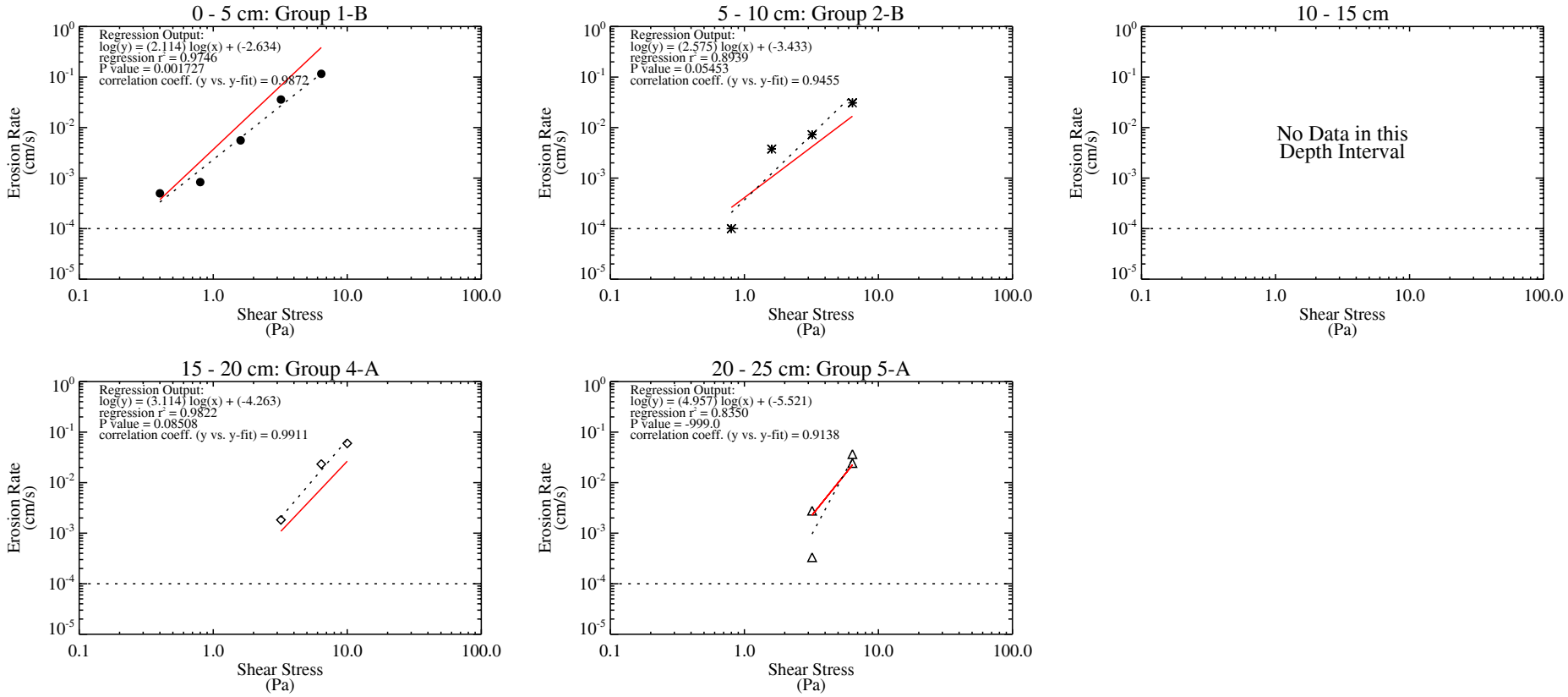

Figure A-4. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-4. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

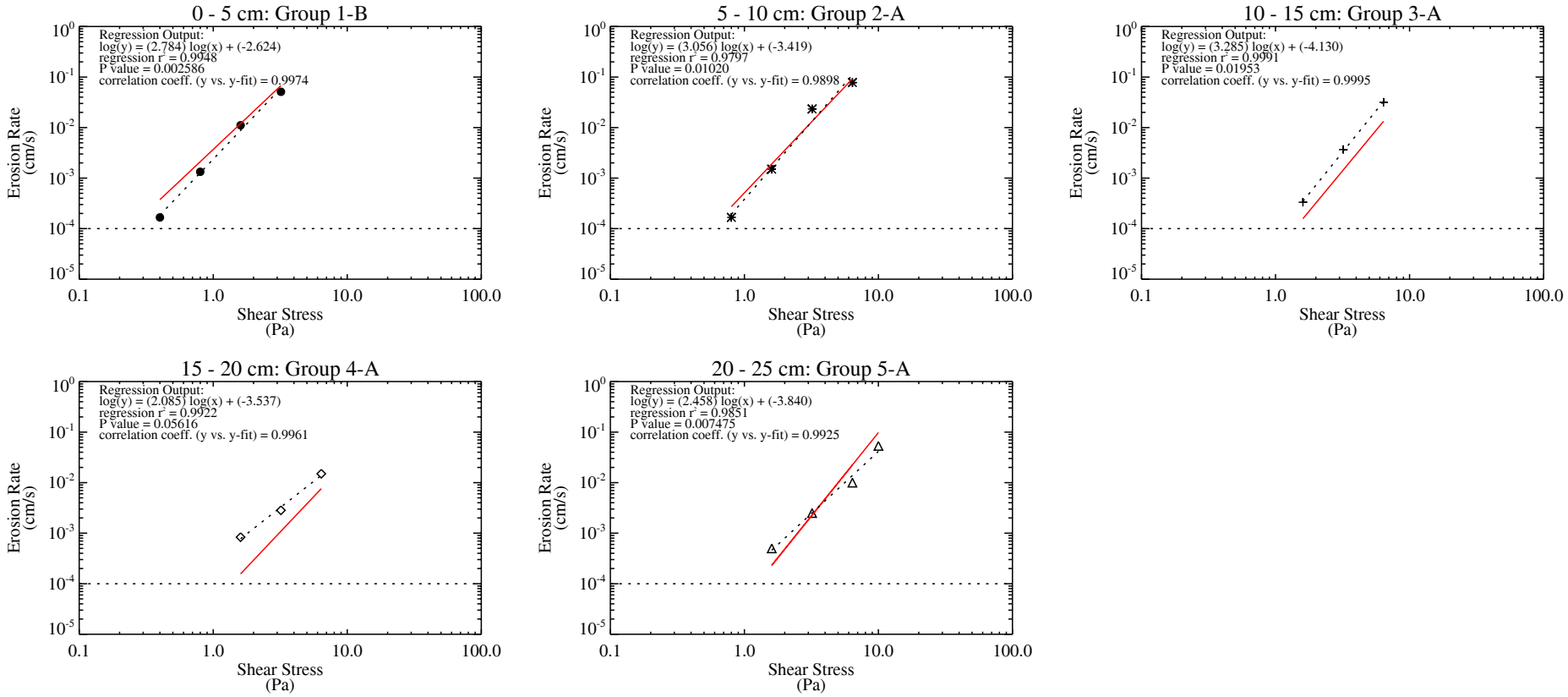

Figure A-5. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-6-R1. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

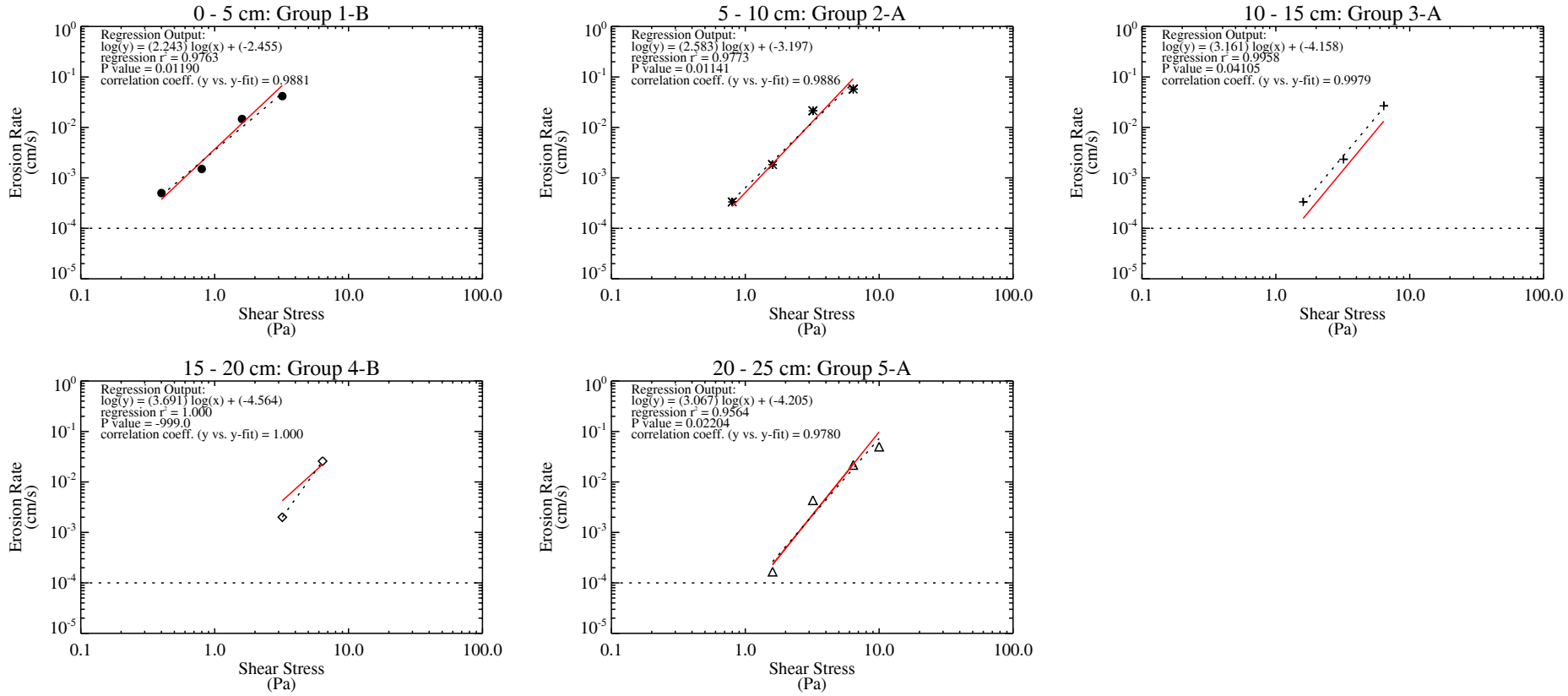

Figure A-6. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-6-R2. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

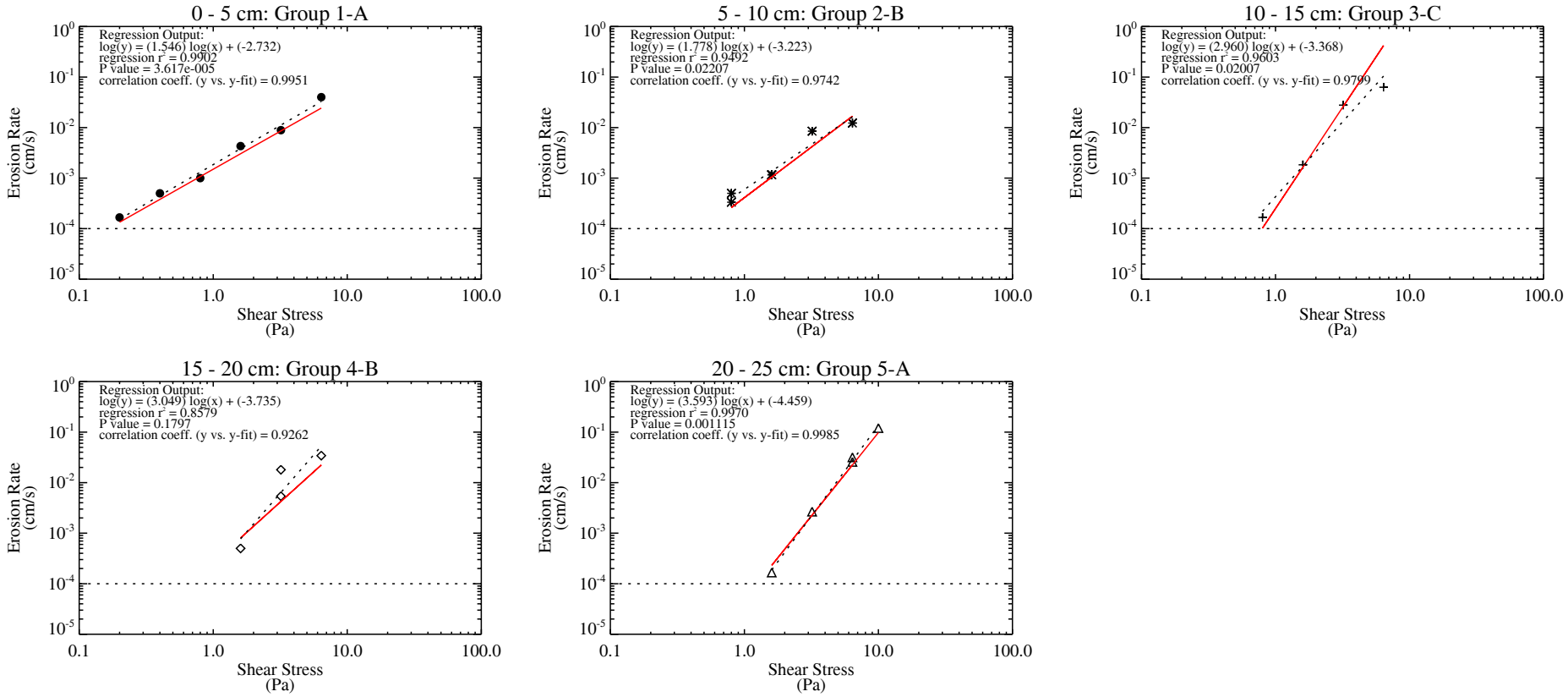

Figure A-7. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-7. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

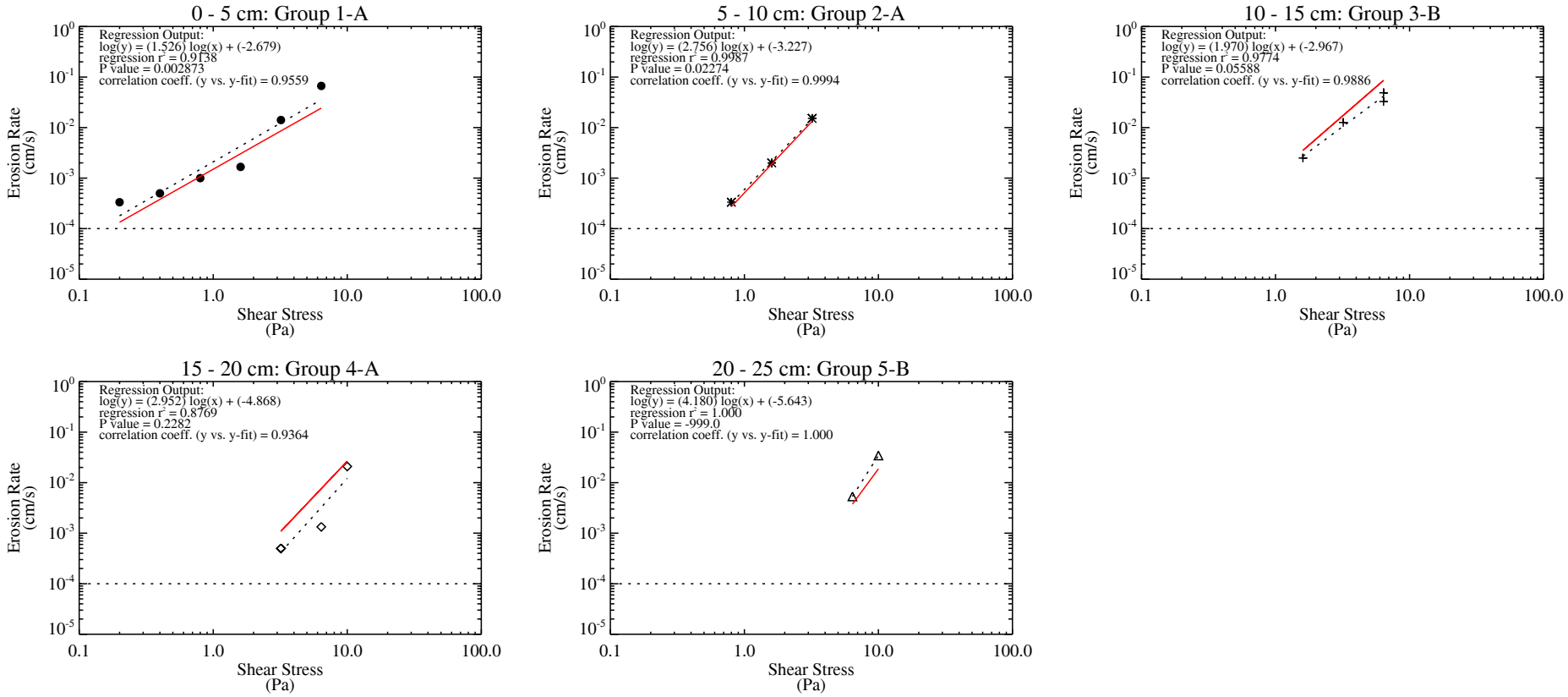

Figure A-8. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-8. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

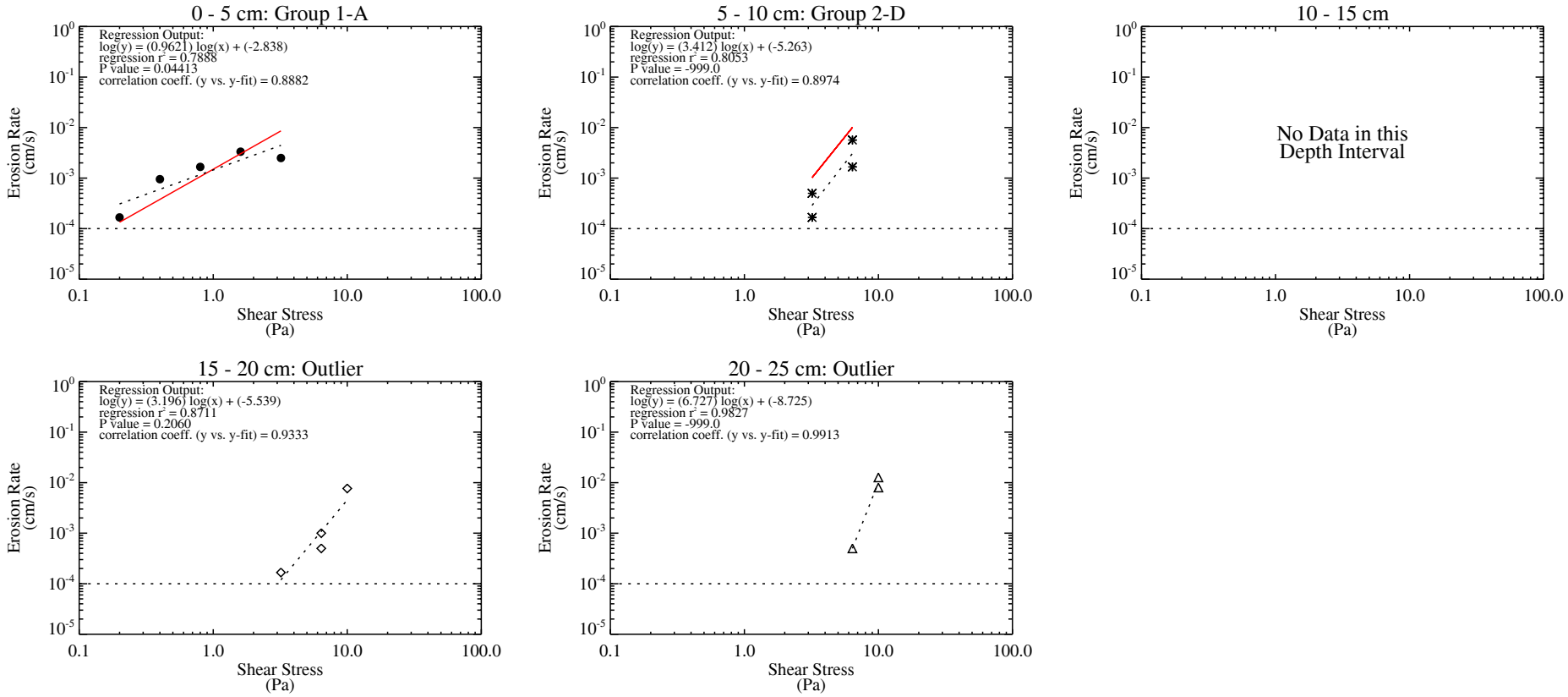

Figure A-9. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-9. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

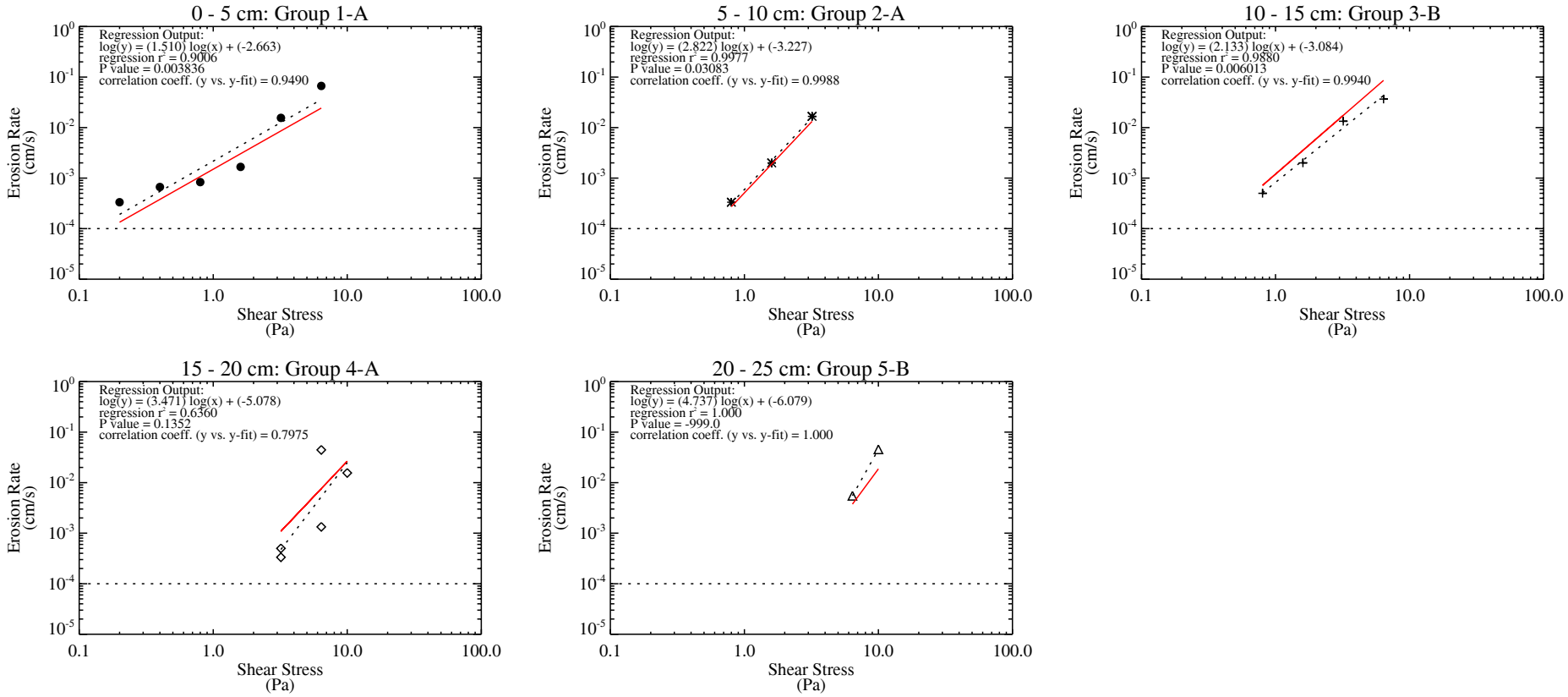

Figure A-10. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-10. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

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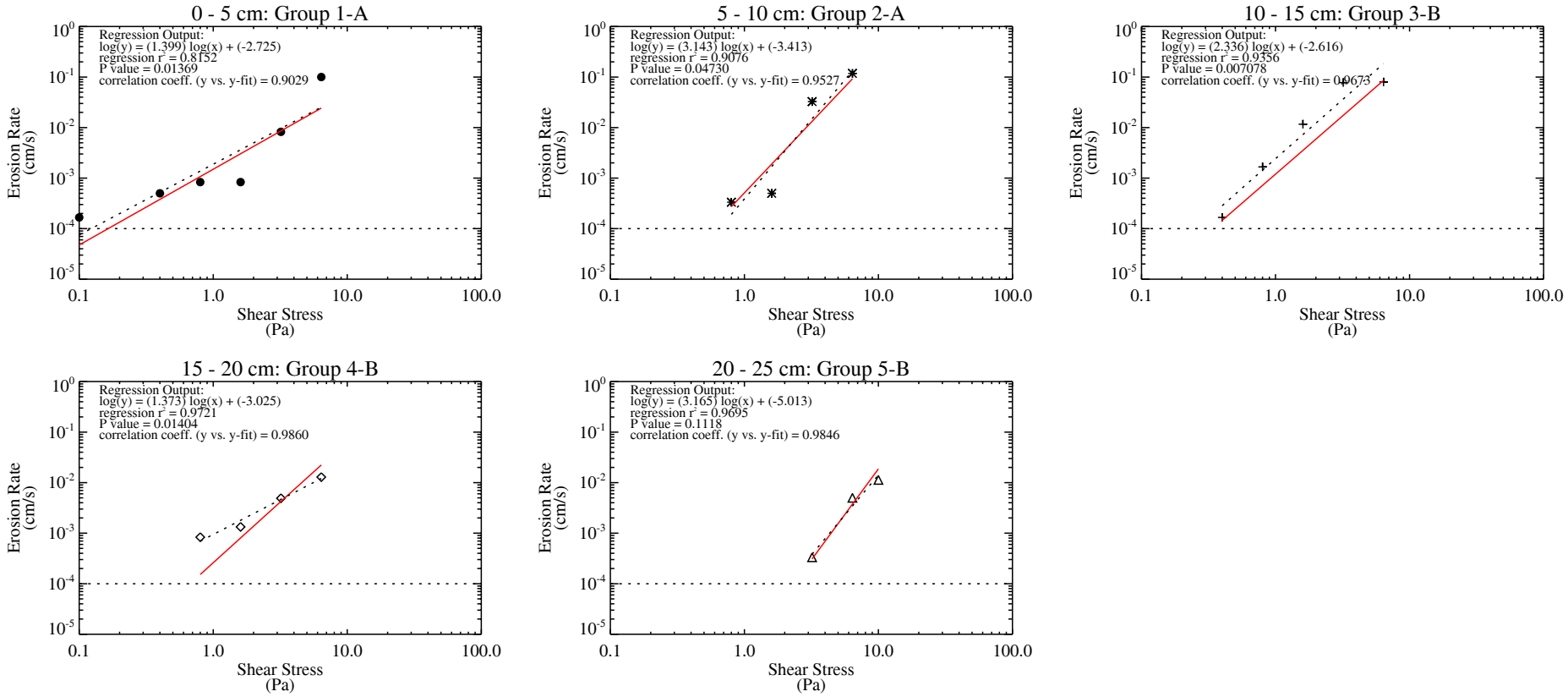

Figure A-11. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-11. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

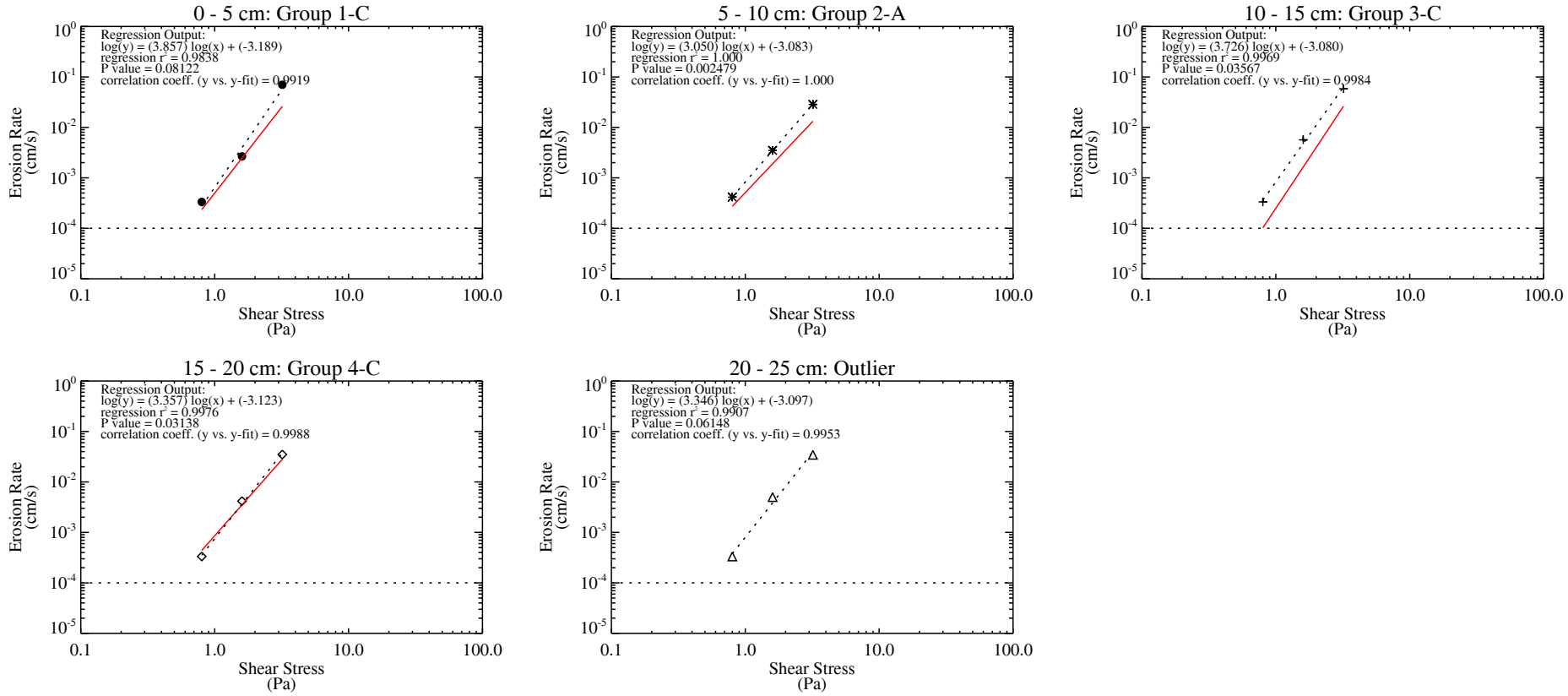

Figure A-12. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-12. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

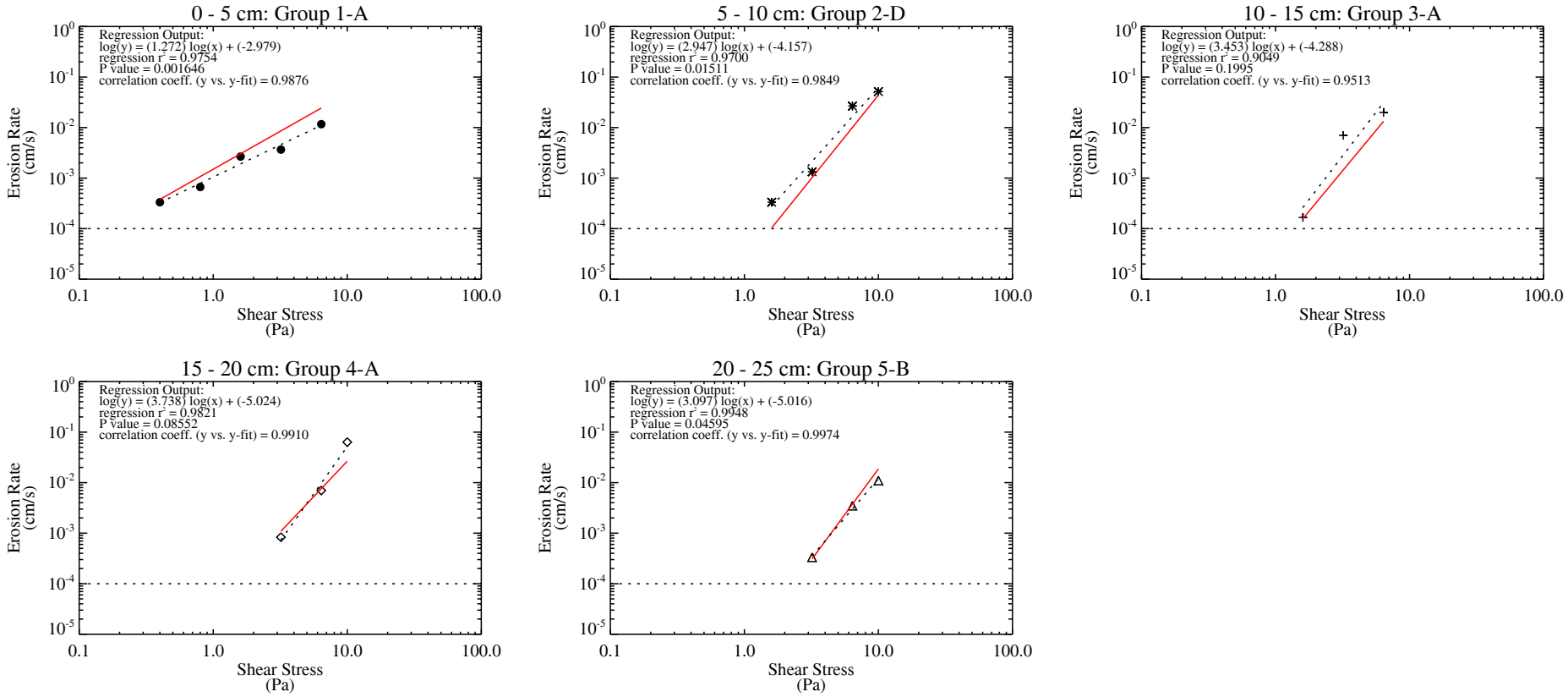

Figure A-13. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-13. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

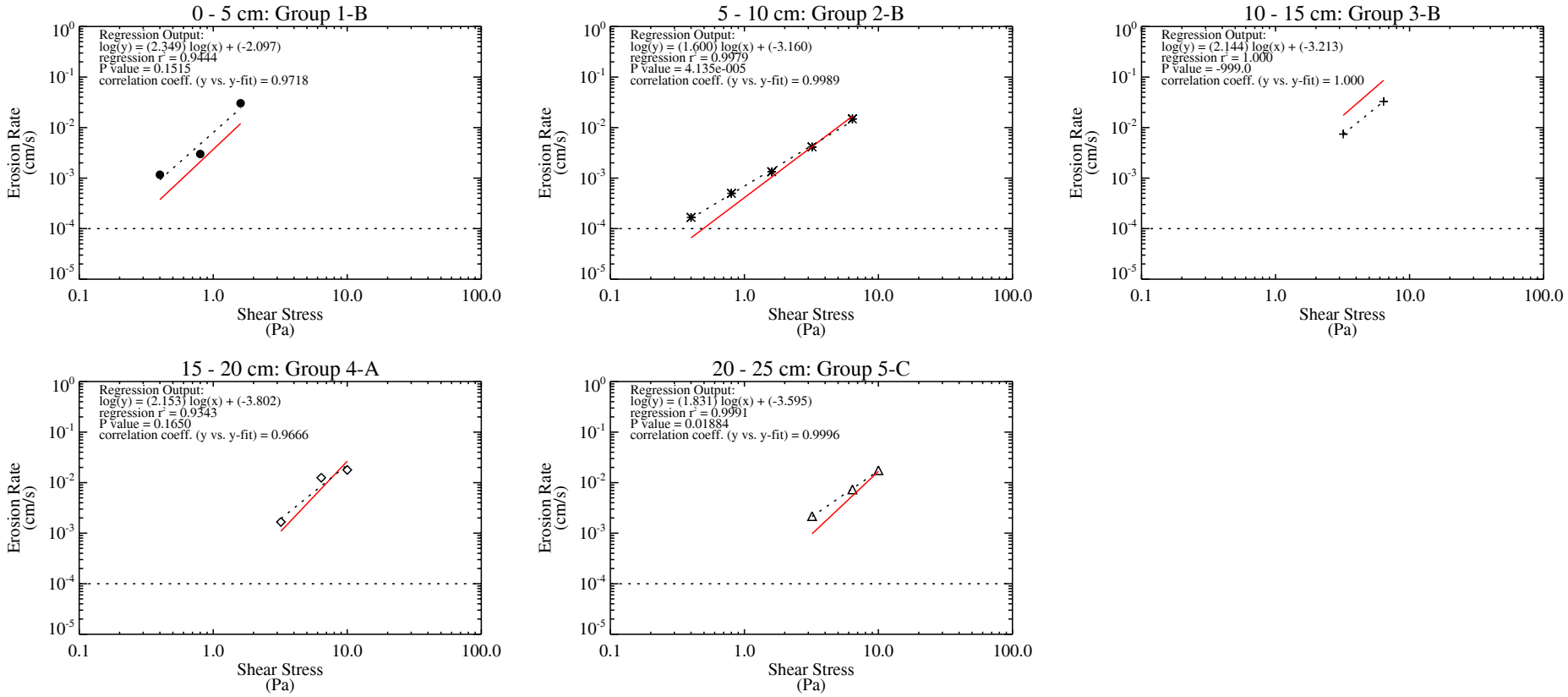

Figure A-14. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-14. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

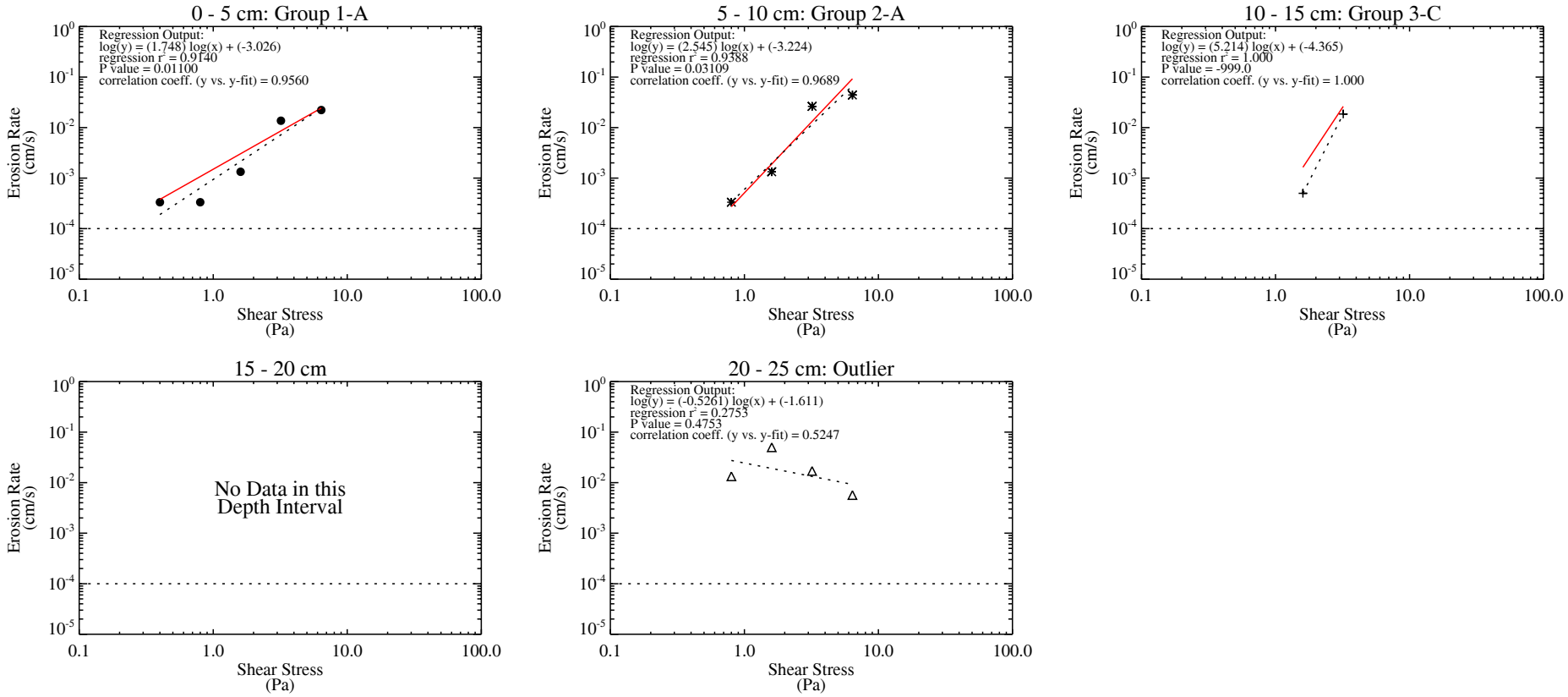

Figure A-15. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-15. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

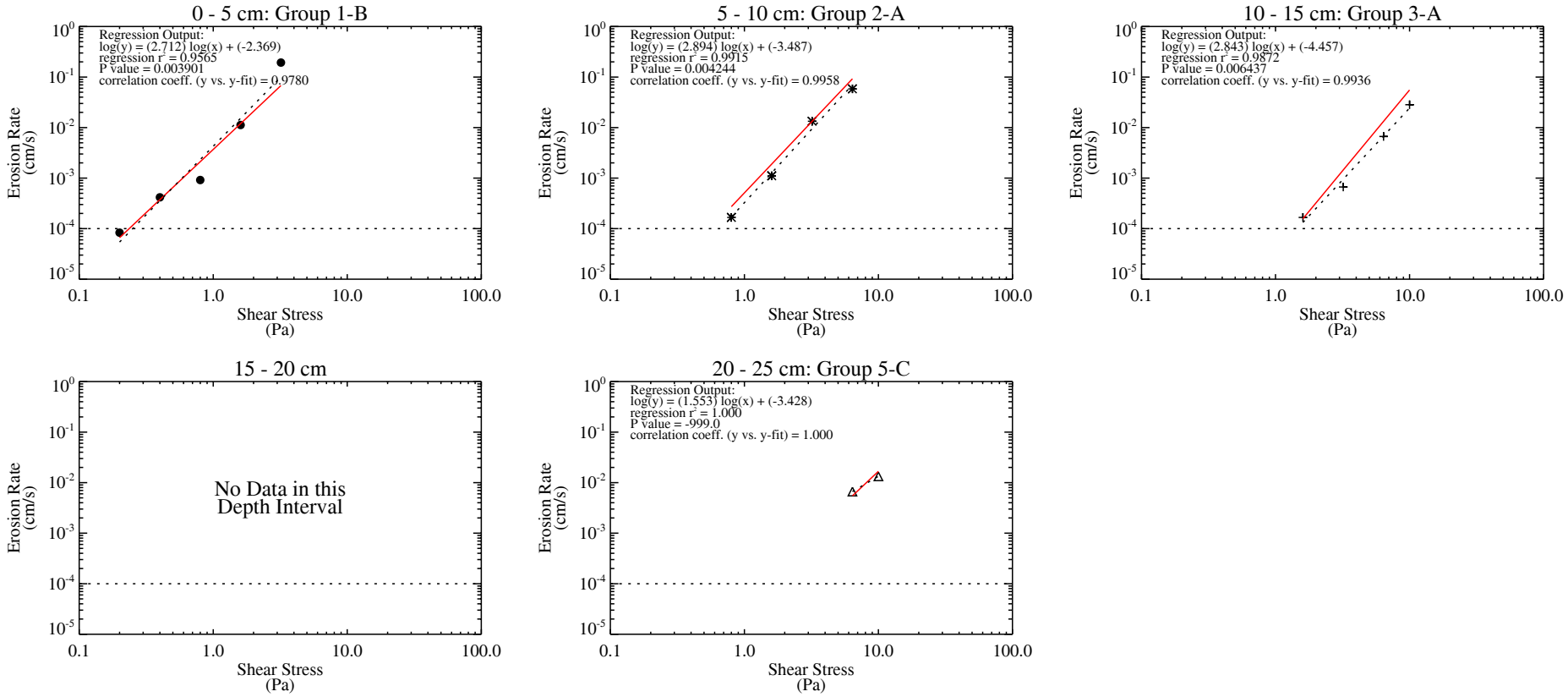

Figure A-16. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-16-R1. Solid line represents average regression line for a specific group of cores, which is noted o each panel.

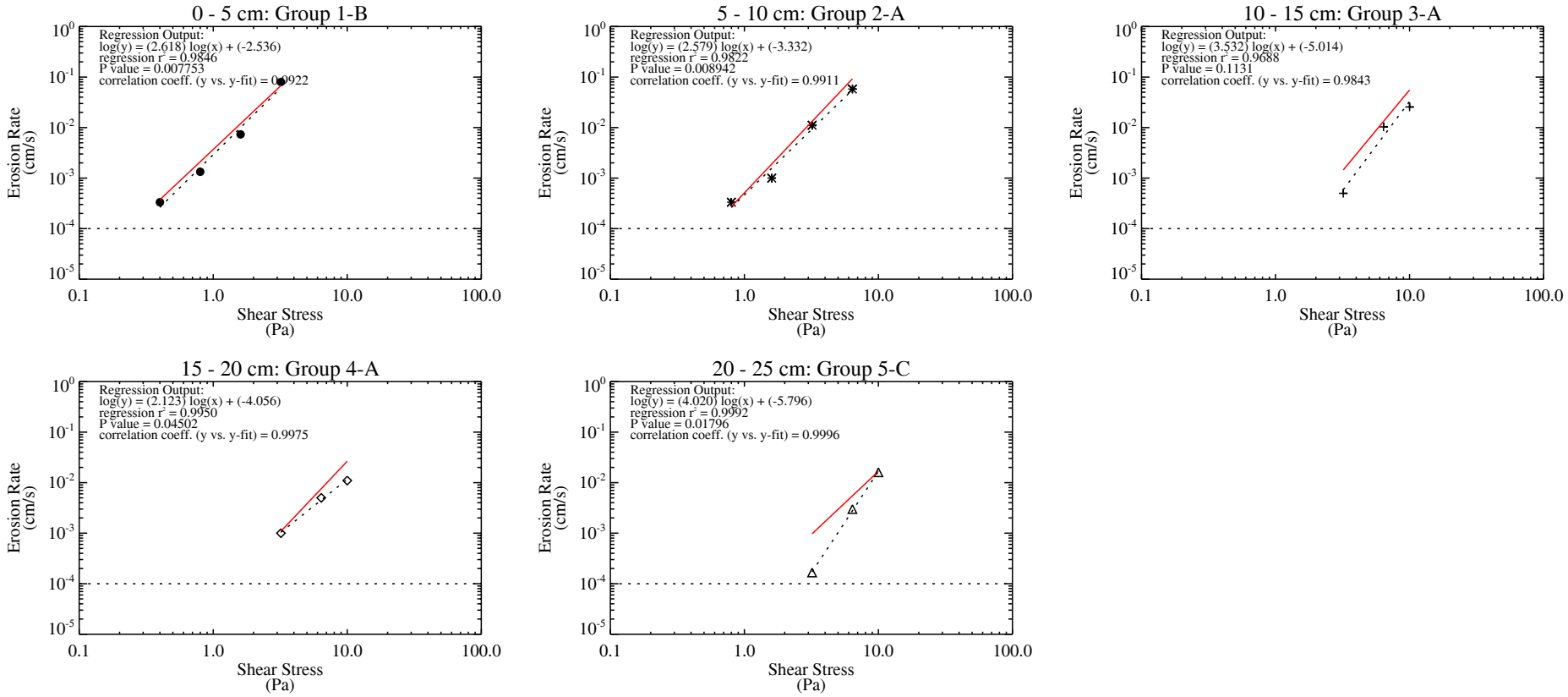

Figure A-17. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-16-R2. Solid line represents average regression line for a specific group of cores, which is noted o each panel.

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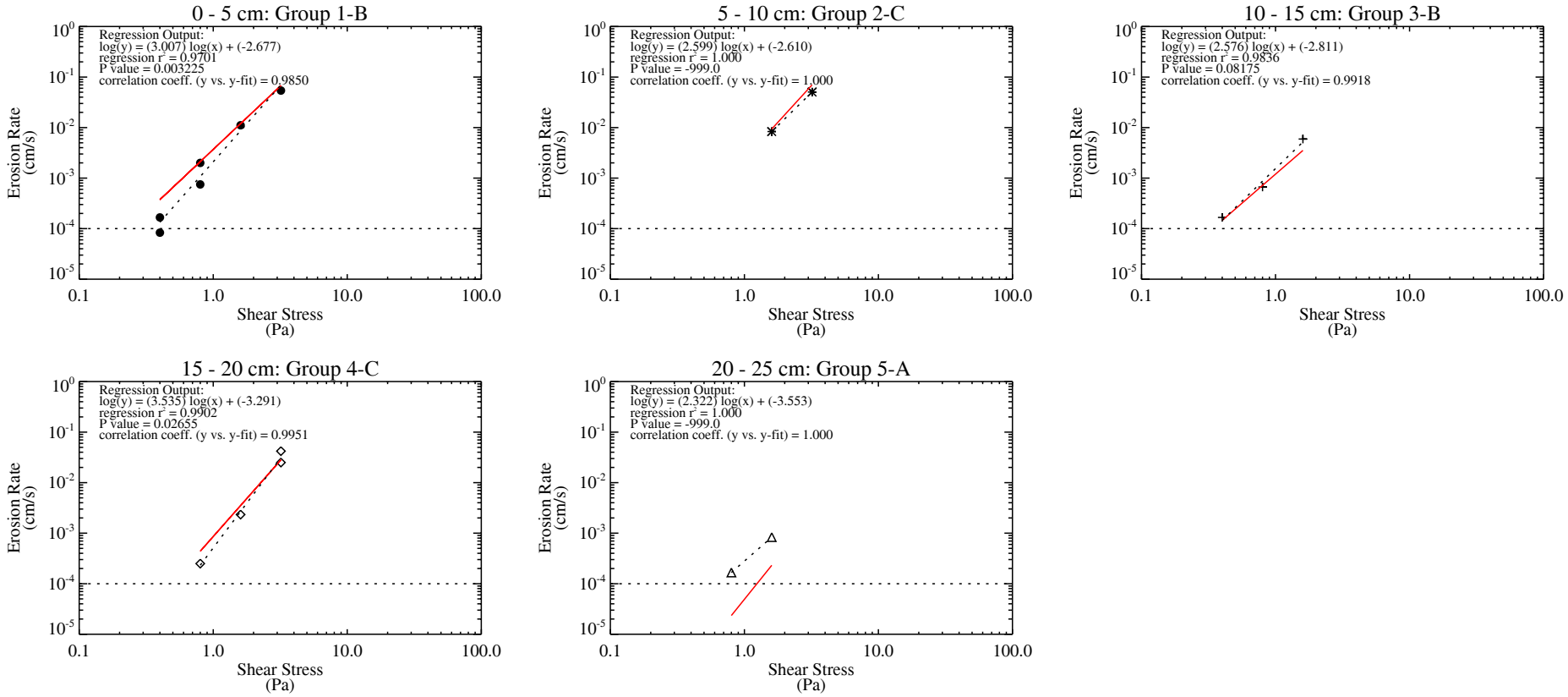

Figure A-18. Comparison of data (symbols) to results of log-linear regression analysis (dashed line) for 5-cm layers in core Sf-17. Solid line represents average regression line for a specific group of cores, which is noted on each panel.

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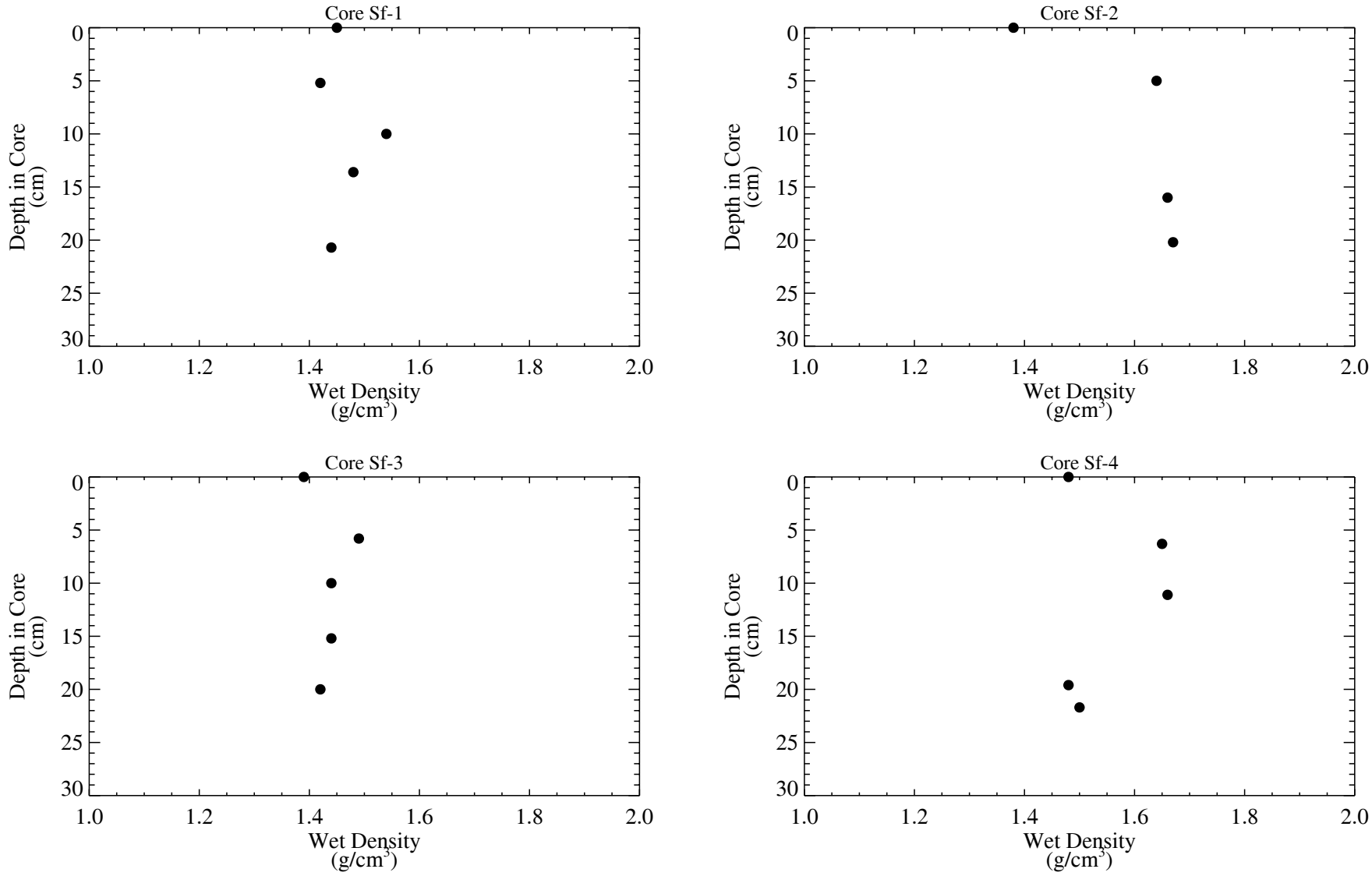

Figure A-19. Vertical profiles of wet density for Sedflume cores Sf-1 to Sf-4.

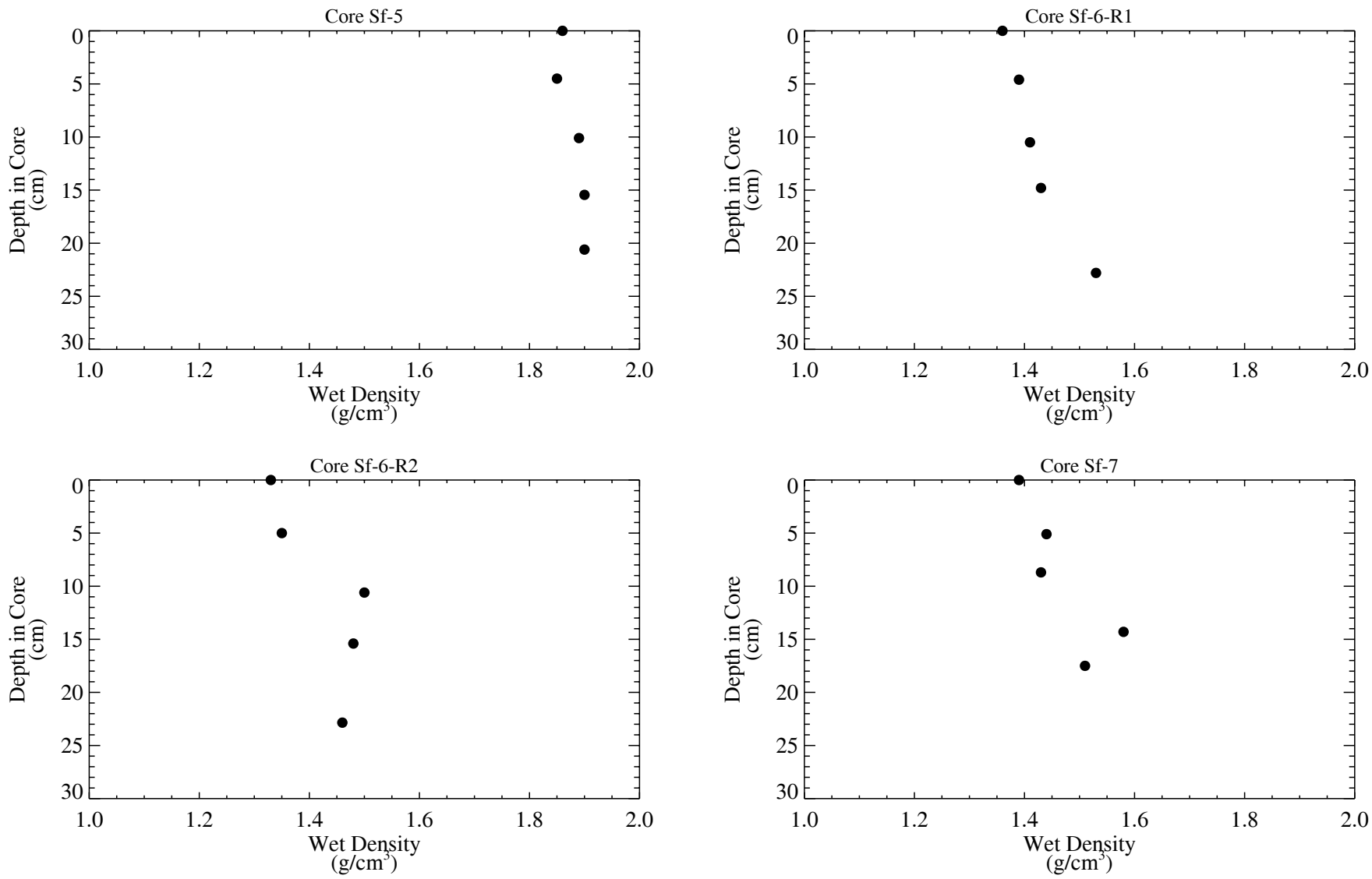

Figure A-20. Vertical profiles of wet density for Sedflume cores Sf-5 to Sf-7.

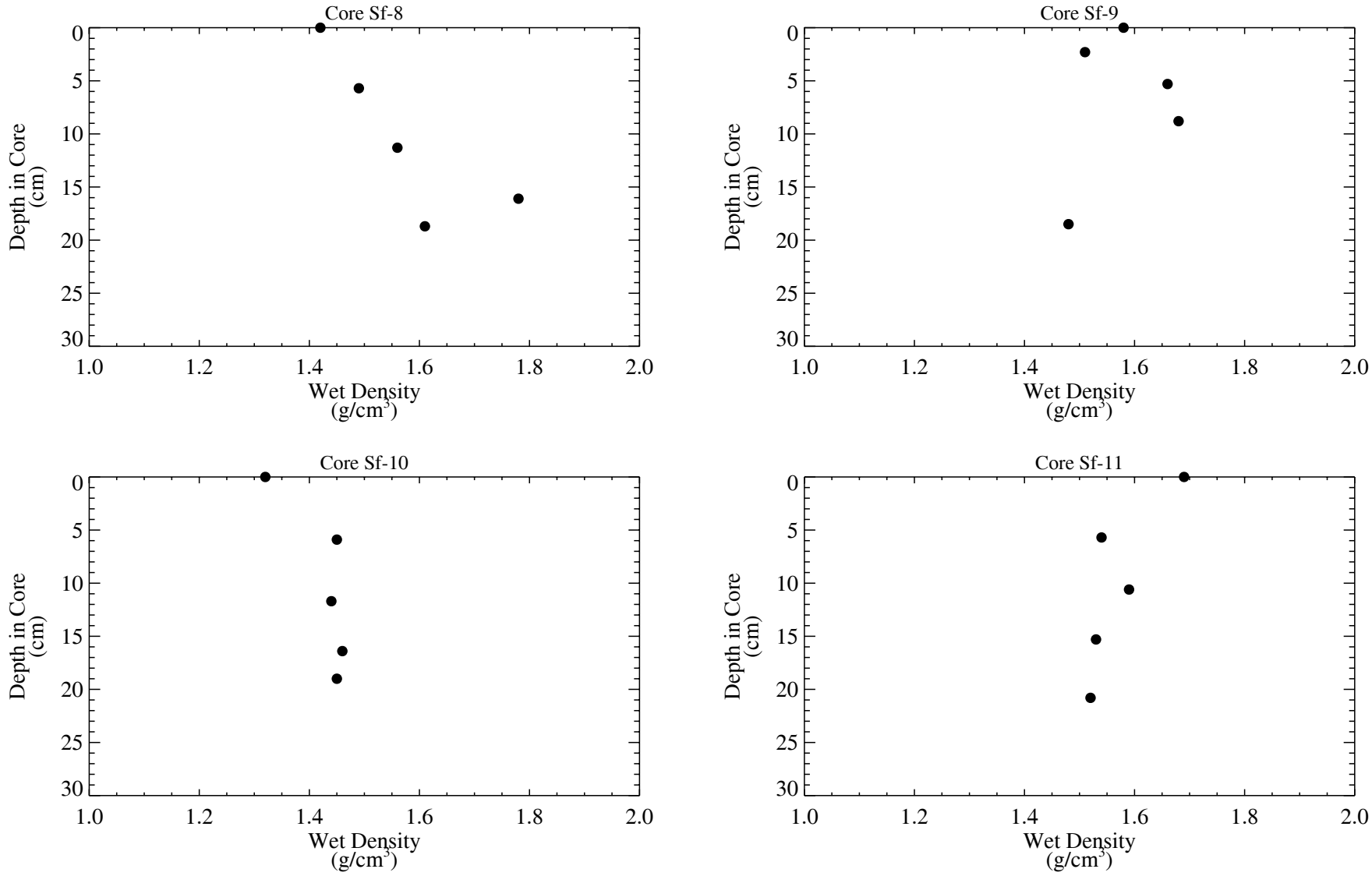

Figure A-21. Vertical profiles of wet density for Sedflume cores Sf-8 to Sf-11.

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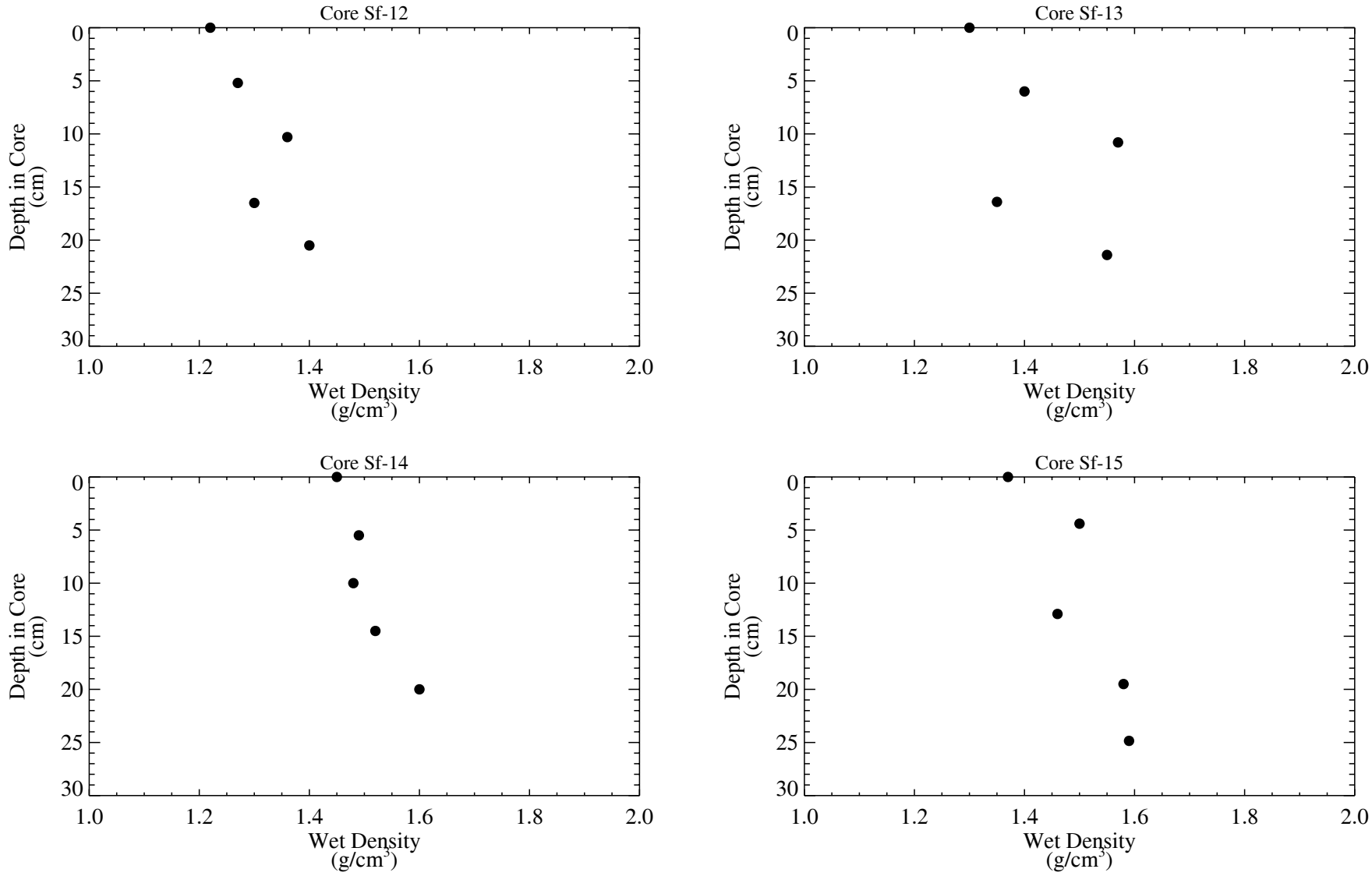

Figure A-22. Vertical profiles of wet density for Sedflume cores Sf-12 to Sf-15.

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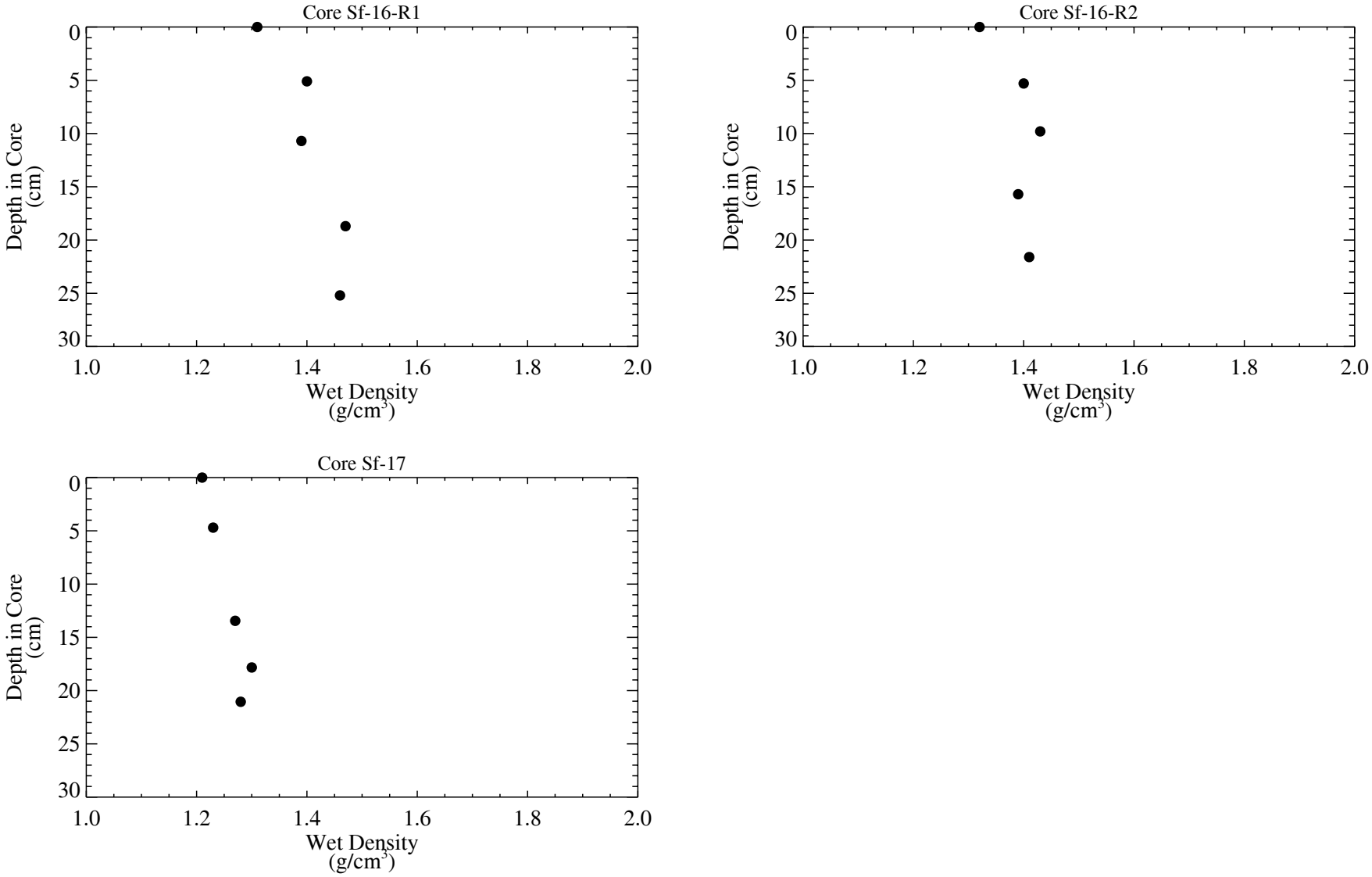

Figure A-23. Vertical profiles of wet density for Sedflume cores Sf-16 to Sf-17.

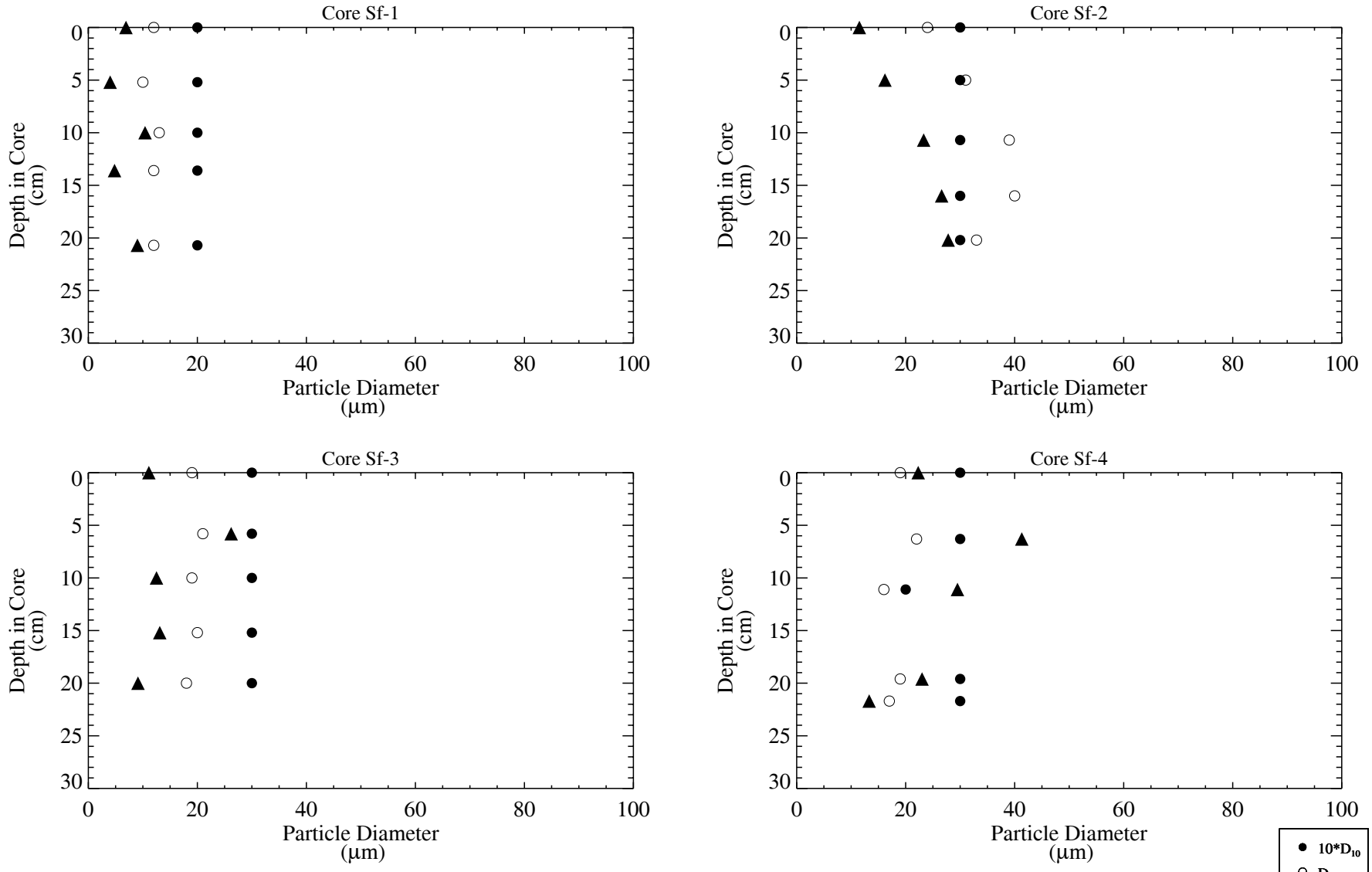

Figure A-24. Vertical profiles of particle size distribution for Sedflume cores Sf-1 to Sf-4.

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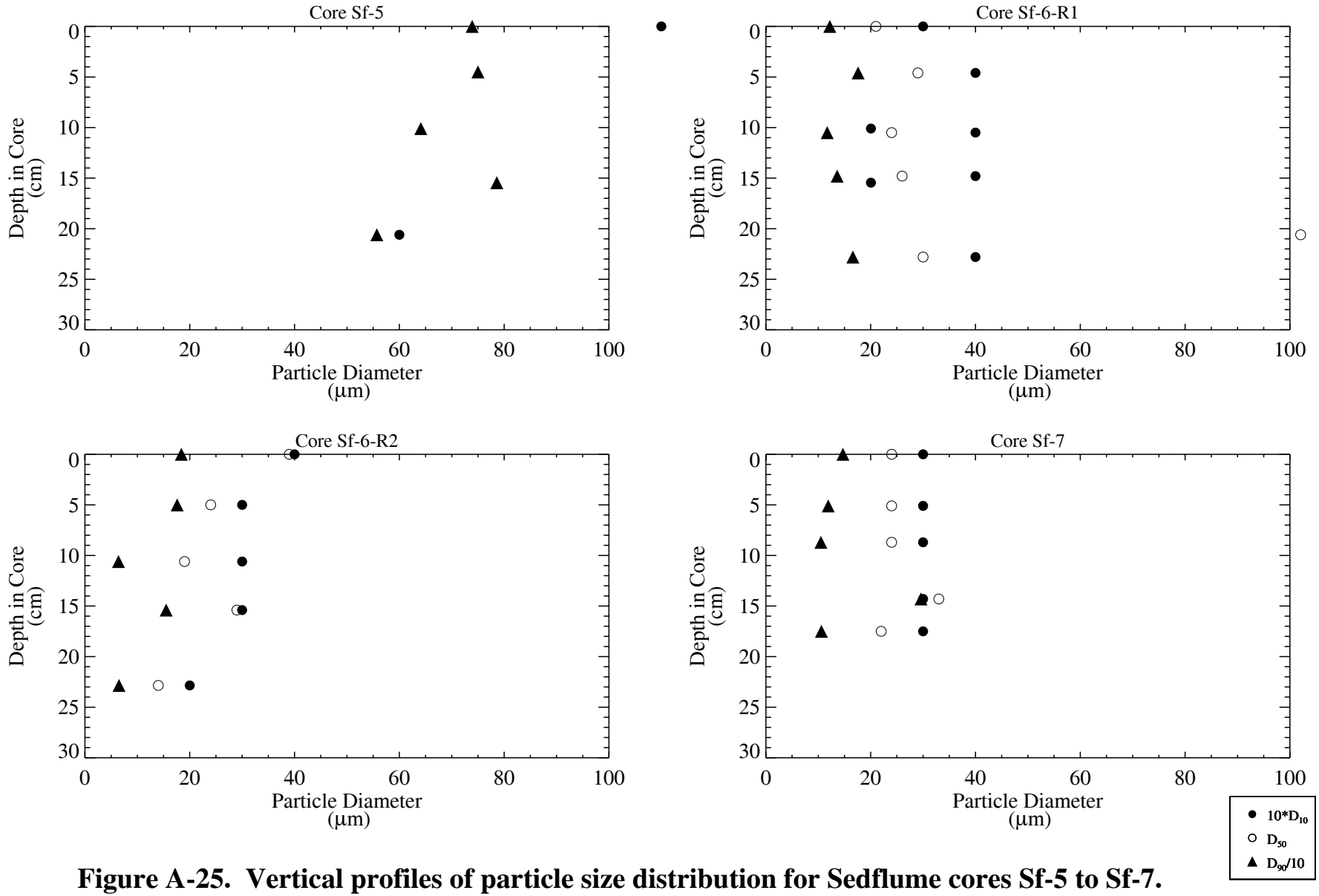

Figure A-25. Vertical profiles of particle size distribution for Sedflume cores Sf-5 to Sf-7.

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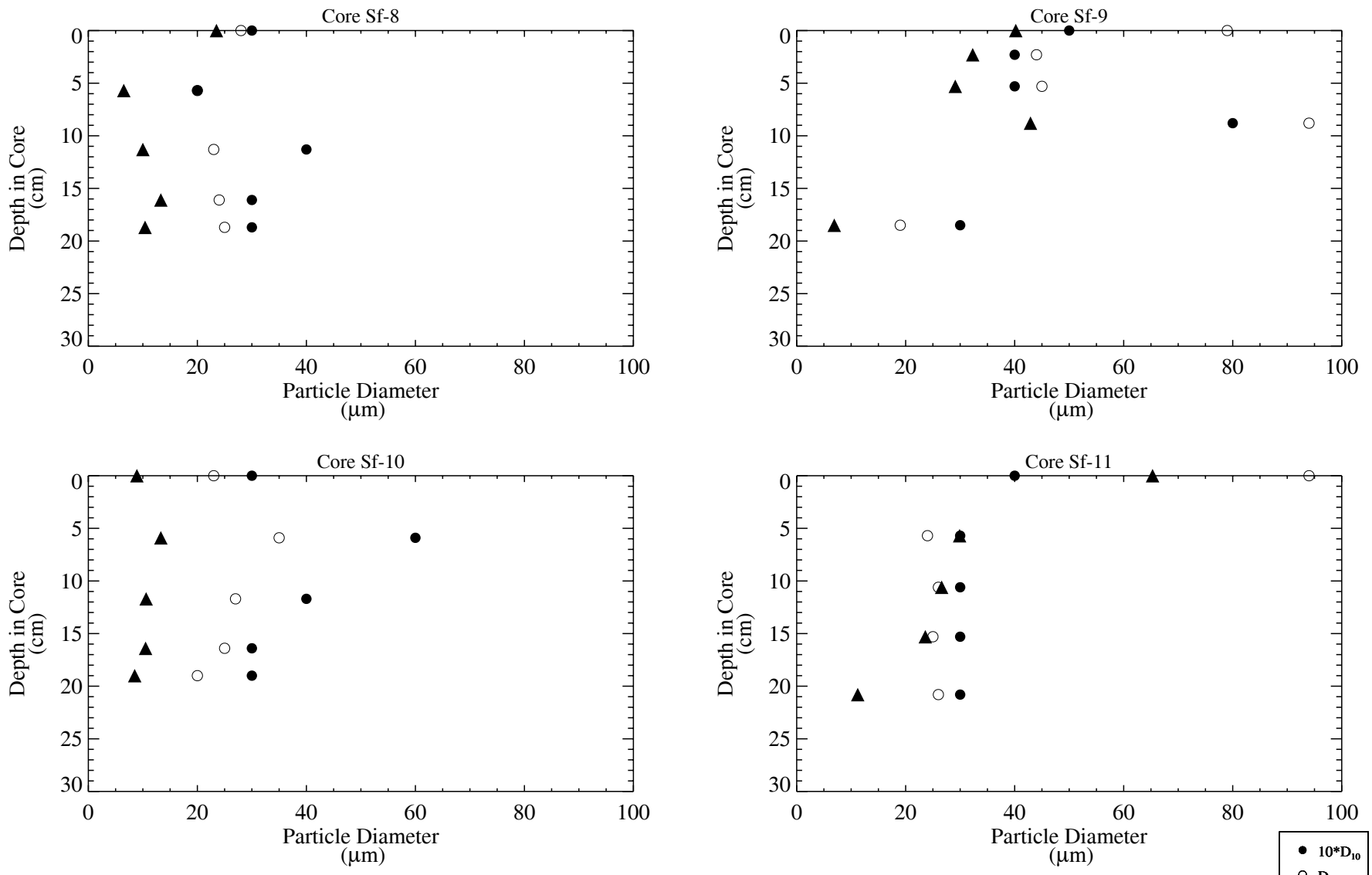

Figure A-26. Vertical profiles of particle size distribution for Sedflume cores Sf-8 to Sf-11.

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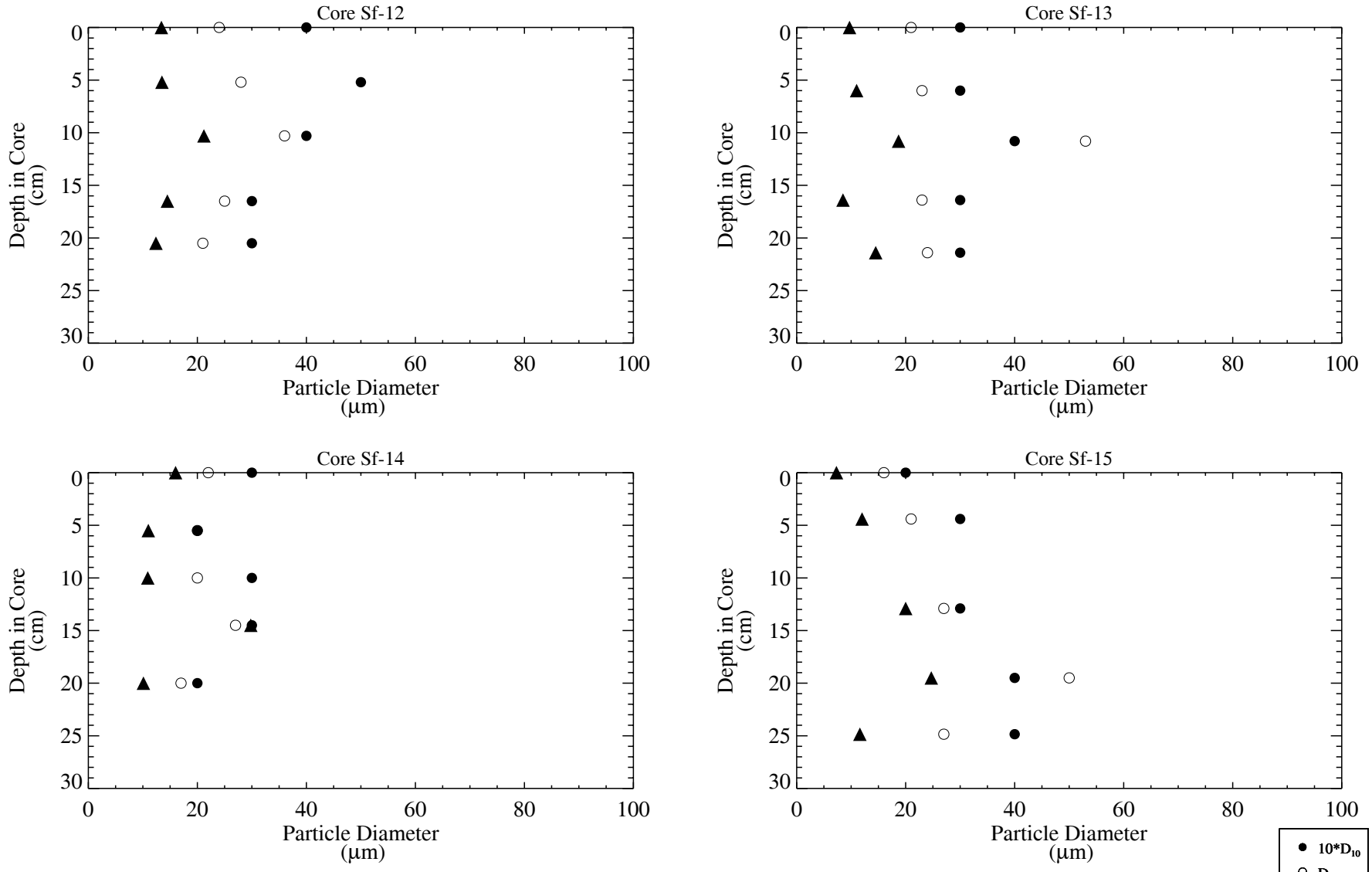

Figure A-27. Vertical profiles of particle size distribution for Sedflume cores Sf-12 to Sf-15.

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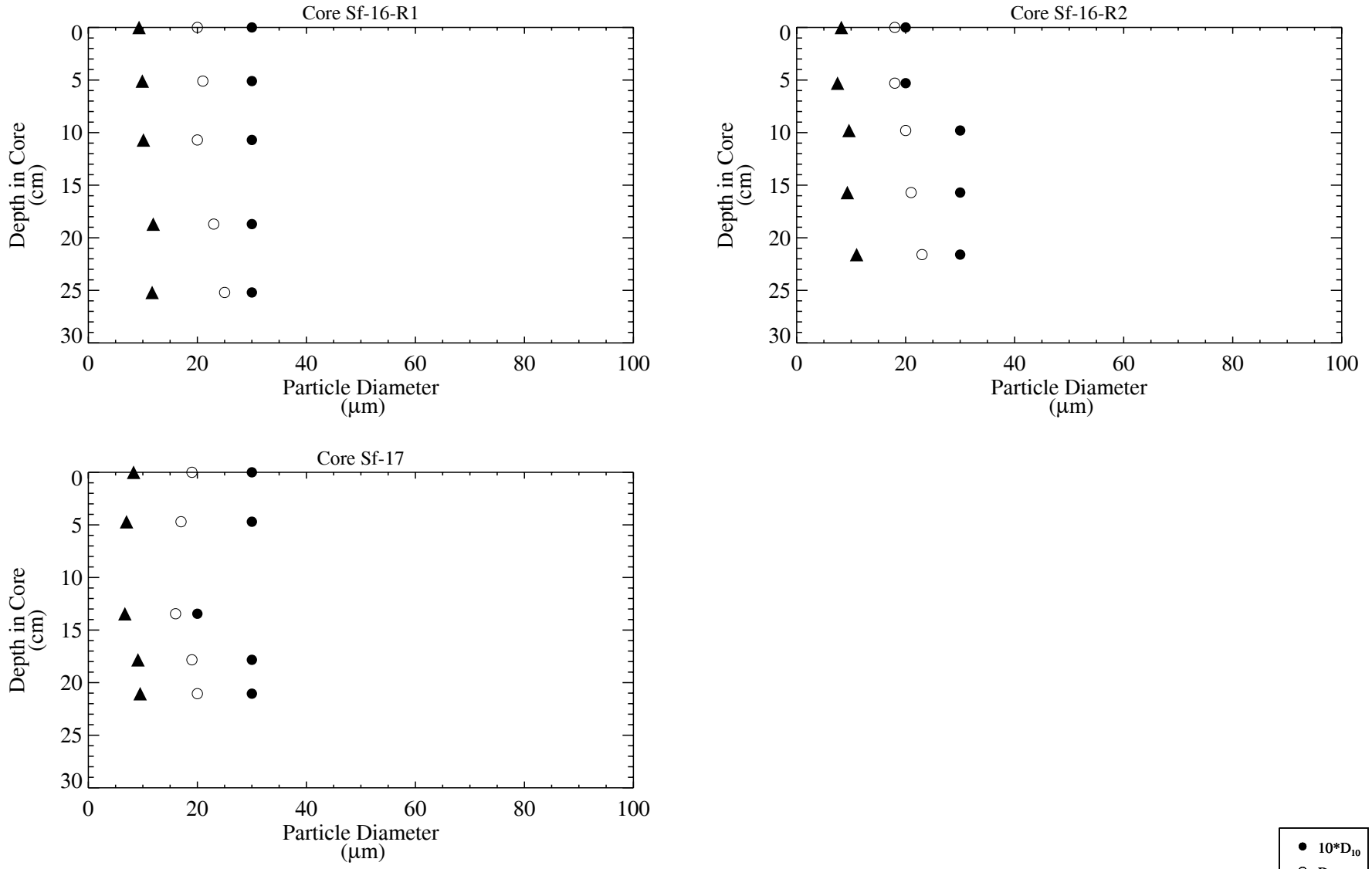

Figure A-28. Vertical profiles of particle size distribution for Sedflume cores Sf-16 to Sf-17.

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