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Additional stratigraphic information and grain size calibration

Timothy J. Bralower: Grain size of Cretaceous-Paleogene Boundary Sediments from Chicxulub to the Open Ocean: Implications for the Interpretation of the Mass Extinction Event

Splicing of KT-1 Core with CM-1 Section of Cottonmouth Creek

We have spliced the KT-1 Core with CM-1 Section of Cottonmouth Creek (Fig. DR1b) by measuring the distance of samples in the CM-1 section below the mass flow deposit and subtracting these distances from the base of the KT-1 core. This splice is not exact given that the base of the mass flow unit was not recovered in KT-1, but the relative position of the lowermost samples in KT-1 compared to the uppermost samples in CM-1 is confirmed by lithostratigraphy and the abundance of nannofossils. The lowermost KT-1 samples possess mudstone clasts and have sparse nannofossils whereas the uppermost CM-1 samples are pure mudstone and contain abundant nannofossils.

Nannoplankton biostratigraphy of the KT-1 Core at Brazos Texas

The nannoplankton biostratigraphy of outcrop sections at Brazos has been described by Jiang and Gartner (1986). Here we define the K/Pg boundary at the base of the mass flow deposit; however, Jiang and Gartner (1986) placed it just above the HCS unit. These authors noticed the occurrence of species of *Thoracosphaera* and *Braarudosphaera* below the K/Pg boundary (as defined by them), but a significant increase in the abundance of these taxa at this level. Jiang and Gartner (1986) also observed relatively abundant specimens of *Micula decussata* and *Arkhangelskiella cymbiformis* above the boundary as well as a small number of specimens of significantly older Cretaceous taxa such as *Aspidolithus parcus* and *Eiffellithus eximius*, both of which have last occurrences close to the Campanian/Maastrichtian boundary.

We have also identified specimens of *Eiffellithus eximius* and *Micula murus* above the boundary as defined here. These taxa have ranges that are not overlapping (the LO of *E. eximius* is close to the Campanian/Maastrichtian boundary and the FO of *M. murus* is in the late Maastrichtian). In addition we notice a sharp increase in the abundance of *Thoracosphaera* and *Braarudosphaera* in the boundary complex; however neither taxon is nearly as abundant as in samples from lower Paleocene outcrop levels at Brazos that are interpreted to be authochthonous. We have also observed unusual abundances of *Micula decussata* and *Arkhangelskiella cymbiformis.* The latter taxon shows a great deal of size variation with unusually large and small specimens occurring in nearby samples. In addition, many specimens appear to be broken. These fractures are relatively straight and are interpreted to result from mechanical breakage rather than dissolution. The combination of size sorting, fractured specimens and the co-occurrence of nannofossil taxa with ranges that do not overlap suggest that most, if not all, nannoplankton in the boundary deposits in KT-1 are reworked. Moreover, the abundance of *Thoracosphaera* and *Braarudosphaera* in boundary complex samples suggests a component of earliest Paleocene nannoplankton in the assemblage. We speculate that the entire sequence was redeposited in the earliest Paleocene, possibly during a slumping event.

Age of Paleocene samples from YAX-1

The lowermost Paleocene samples at YAX-1 contain a low-diversity assemblage that contains abundant *Thoracosphaera* as well as *Futuyania petalosa*. This allows us to place age limits for the samples of between 5 and 40 k.y. above the K/Pg boundary using orbital chronologic calibration of datums (S. Jiang, pers. comm., 2009).

Calibration of Malvern Mastersizer with Coulter Counter

We carried out a comparison of grain size analysis using the Malvern Mastersizer with Coulter Counter on the <38 μm size fraction of eighteen samples from the Paleocene-Eocene boundary at Site 690 from the Weddell Sea. The Coulter Counter (CC) analyses were carried out at Williams College in the laboratory of Heather Stoll. The CC analyses were performed with a 38 μm aperture while the <38 μm Malvern Mastersizer (MM) analyses were extracted from the complete 0.1-1000 μm analysis. Thus CC data have significantly more size bins than do the MM data and are therefore significantly more detailed. Because of the difference in the way the data were acquired, the absolute abundances are not comparable; however, the trends in the <38 μm data can be compared directly. Broadly speaking, the trends between the CC and MM data are similar (Fig. DR2). The modes of the CC analyses are mostly within 2 μm of the mode of the MM analyses. In most samples, the trends are comparable. Several MM analyses show increases in the 15-20 μm size fraction that are not observed in the CC analyses. These trends result from significant percentages of the sample above 50 μm and thus provide a false comparison with the CC analyses. Repeat MM analysis of two samples shows a high level of reproducibility (Fig. 3). Overall, the results suggest that the MM at minimum provides a sufficiently precise and reproducible grain size measurement for inter-sample comparison.

Previous grain size measurements of section

Smit et al. (1996) measured the grain size of a number of samples from Brazos. However samples were acidified before measurement, thus the data are not directly comparable with those collected here.

References Cited

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Jiang, M.J., and Gartner, S., 1986, Calcareous nannofossil succession across the Cretaceous/Tertiary boundary in east-central Texas: *Micropaleontology*, v.32, p.232-255.

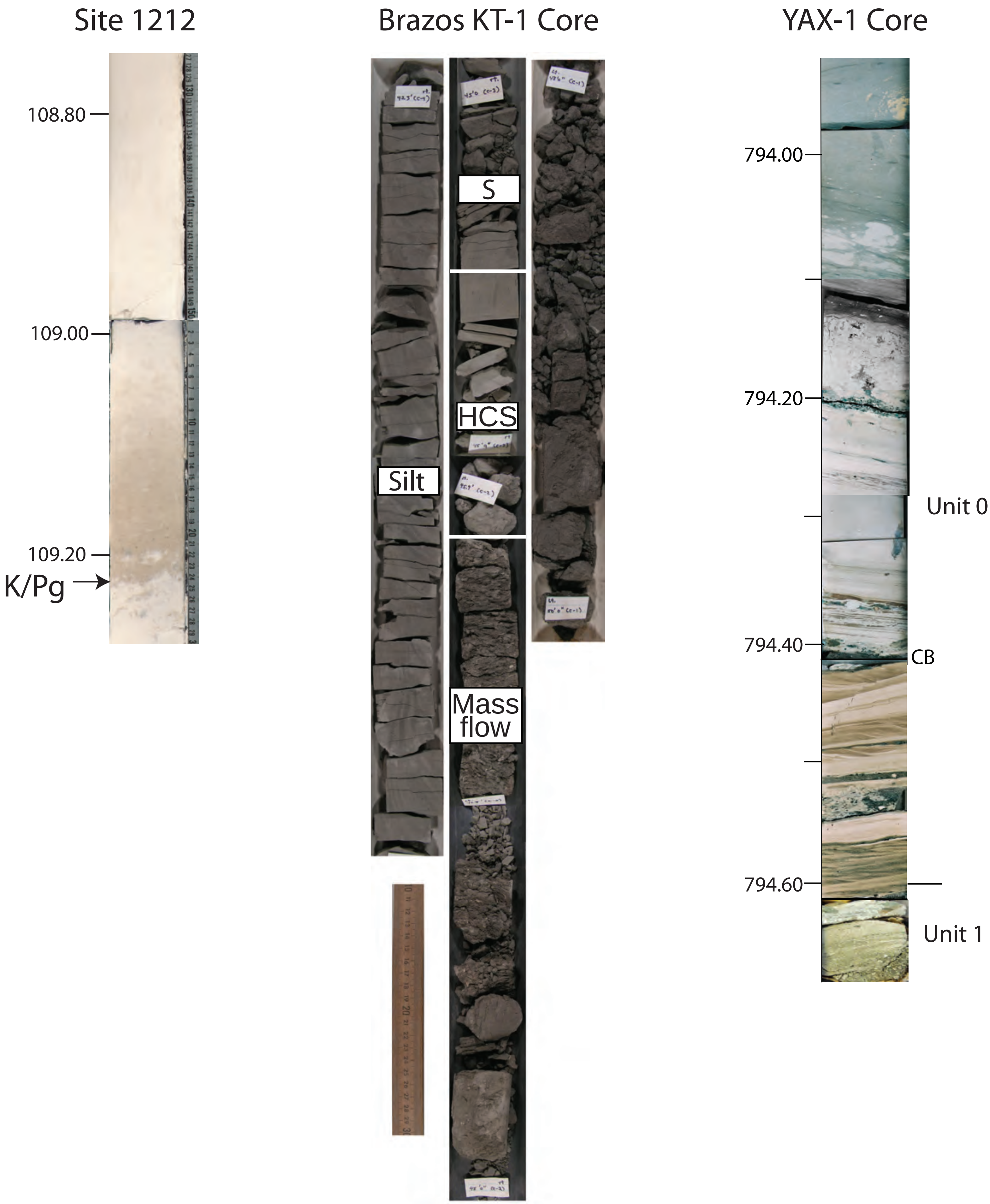
Smit, J., Roep, T.B., Alvarez, W., Montonari, A., Claeys, P., Grajales-Nishimura, J.M., and Bermudez, J., 1996, Coarse-grained, clastic sandstone complex at the K/T boundary around the Gulf of Mexico: deposition by tsunami waves induced by the Chicxulub impact. In: Ryder, G., Fastovsky, D., and Gartner, S. (Eds.), The Cretaceous–Tertiary Event and Other Catastrophes in Earth History. Special Publication of the Geological Society of America, v. 307, p. 151–182.

Figure Captions

Figure DR1. Lithology of sections investigated. Location of K/Pg boundary at Site 1212 shown with arrow (boundary lies below base of study section in KT-1 and YAX cores). Lithologic units are referred to in text. Hole 1212B photograph from Bralower et al. (2006). YAX photograph from Goto et al. (2004). White horizontal lines in Brazos photographs indicates unit boundaries indicated with labels: HCS-hummocky cross-bedded sand; S-settling out unit; Silt-muddy siltstone unit. All photographs are at different scales; separate centimeter scales shown for Site 1212 and KT-1. CB=core break.

Figure DR2. Comparison of analyses of <38 μm fraction using the Malvern Mastersizer (red line) and the Coulter Counter (blue line). Samples from ODP Hole 690B, depths shown in meters below sea floor.

Figure DR3. Repeat analyses of two samples from Hole 690B using the Malvern Mastersizer.



Site 1212
108.80
109.00
109.20
K/Pg
Brazos KT-1 Core
S
HCS
Silt
Mass flow
YAX-1 Core
794.00
794.20
794.40
794.60
Unit 0
CB
Unit 1

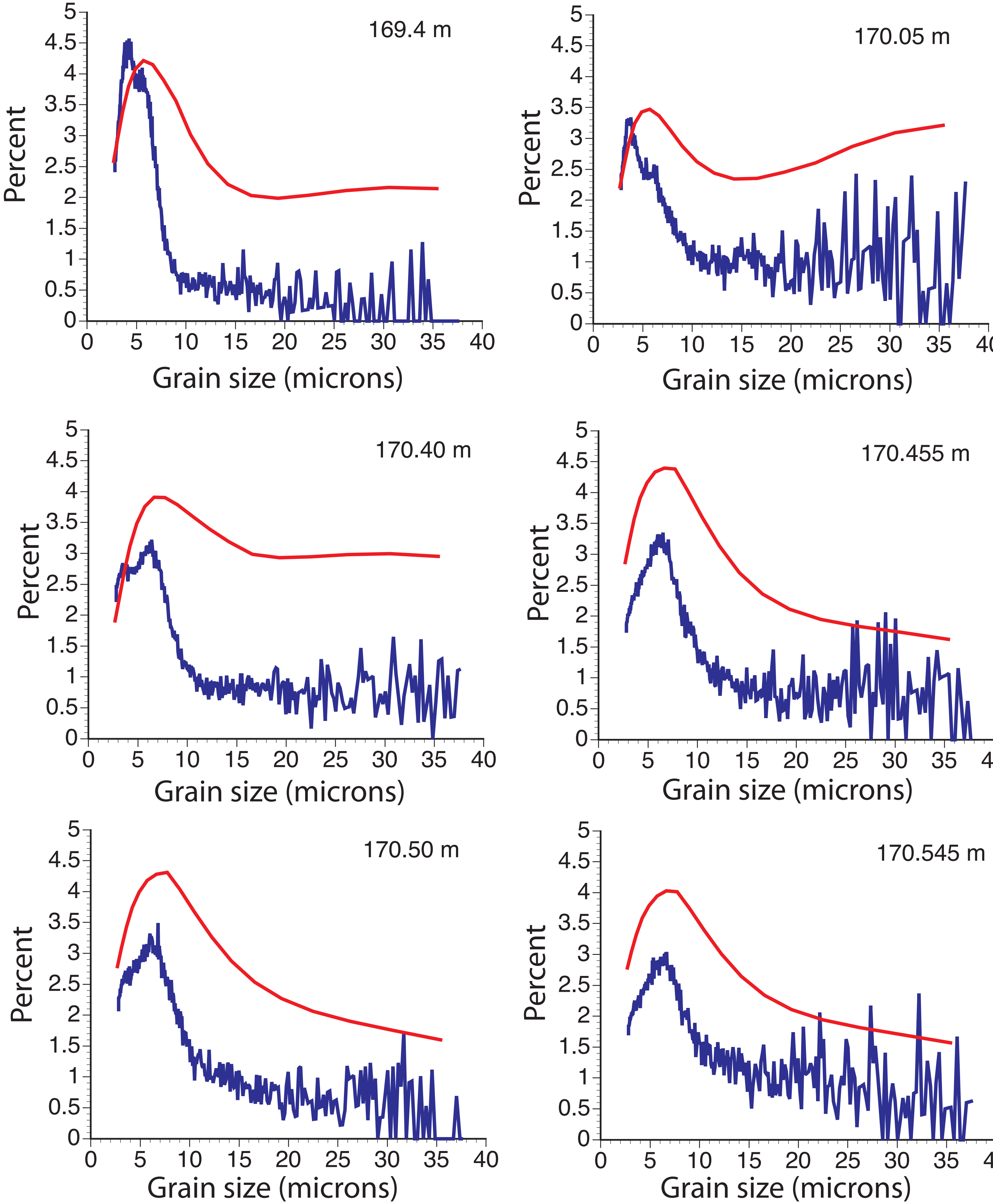

169.4 m
170.05 m
170.40 m
170.455 m
170.50 m
170.545 m
Percent
Grain size (microns)
0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5
0 5 10 15 20 25 30 35 40

Figure DR2a

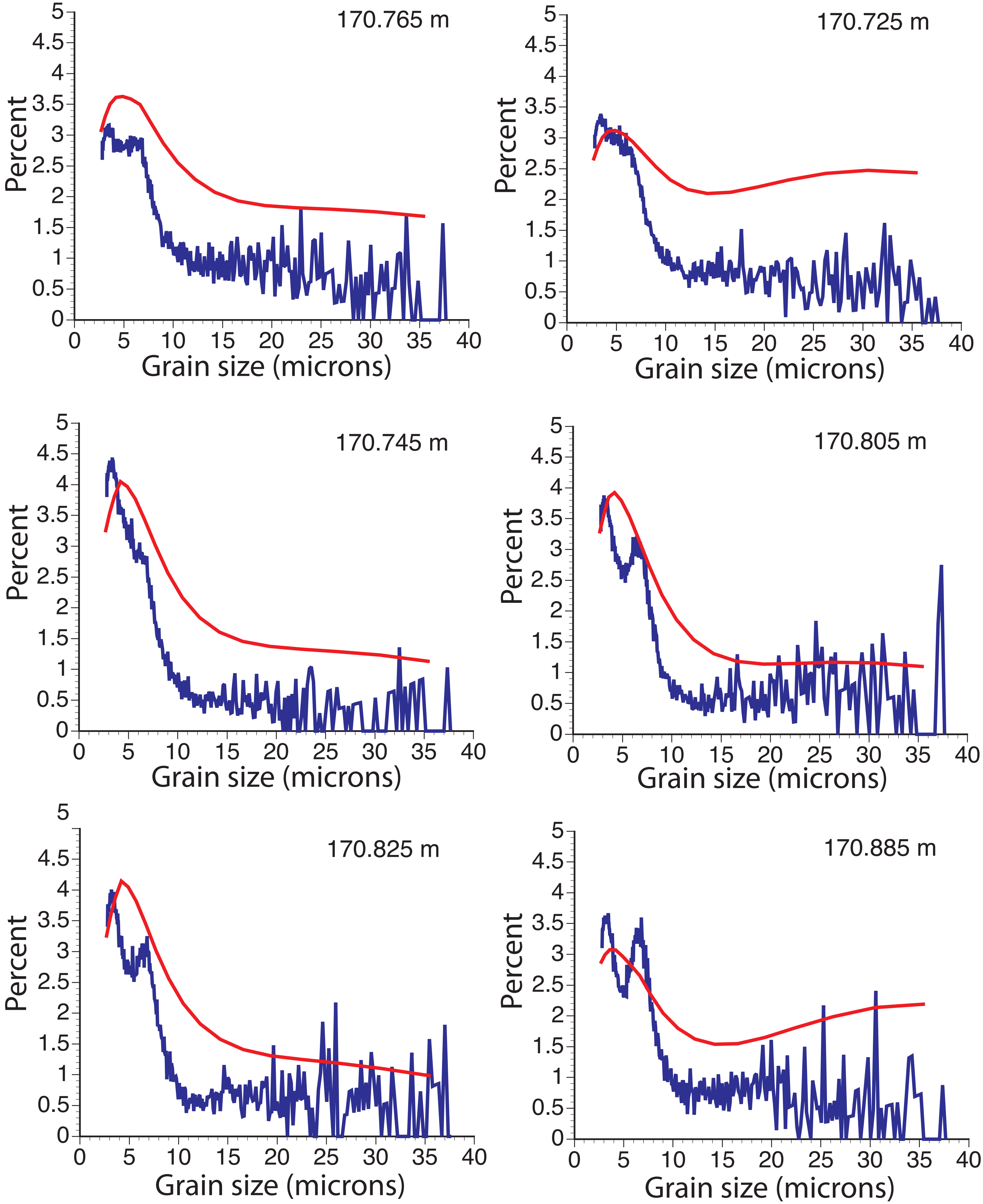

170.765 m
170.725 m
170.745 m
170.805 m
170.825 m
170.885 m
Percent
Grain size (microns)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
0
5
10
15
20
25
30
35
40

Figure DR2b

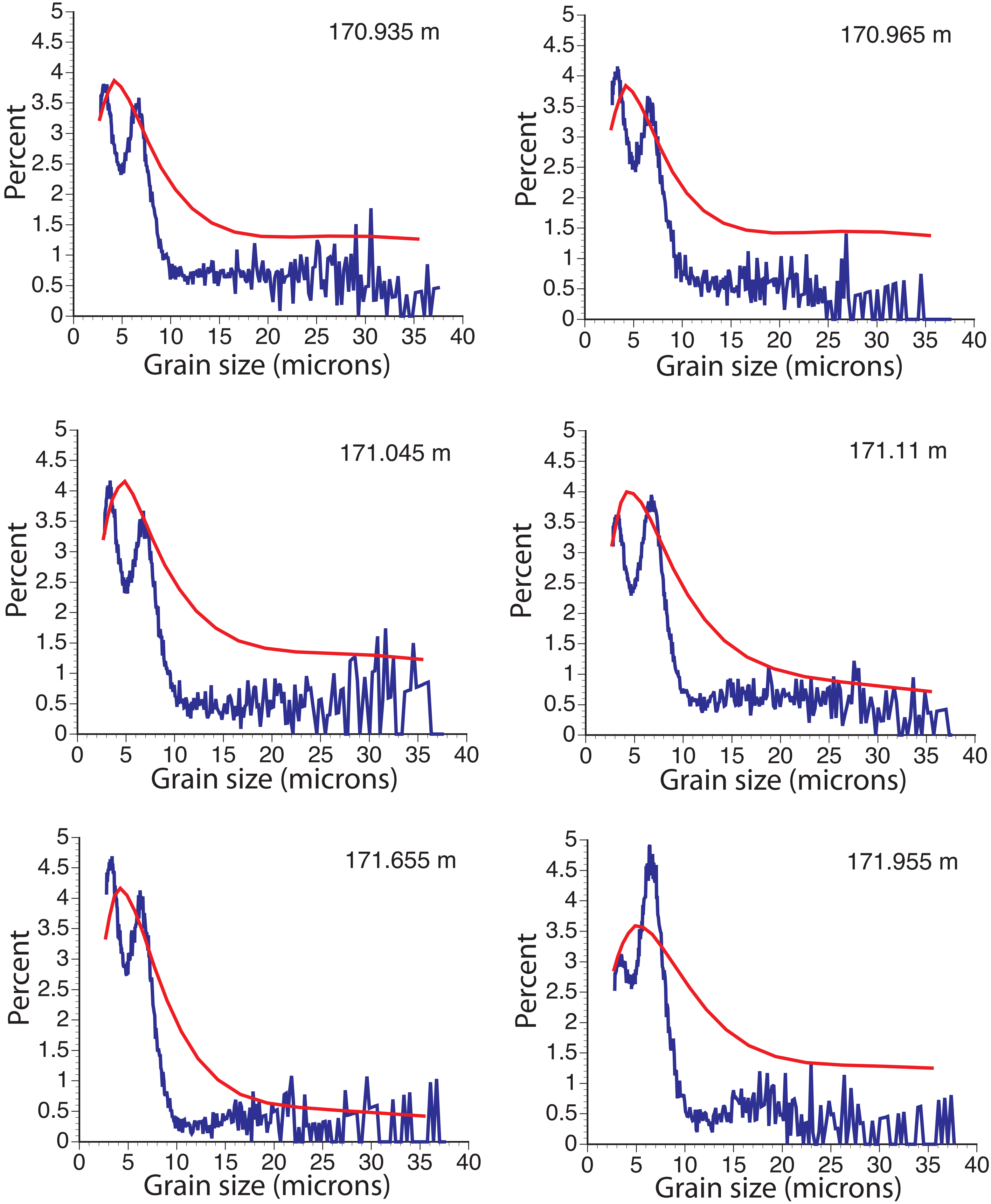
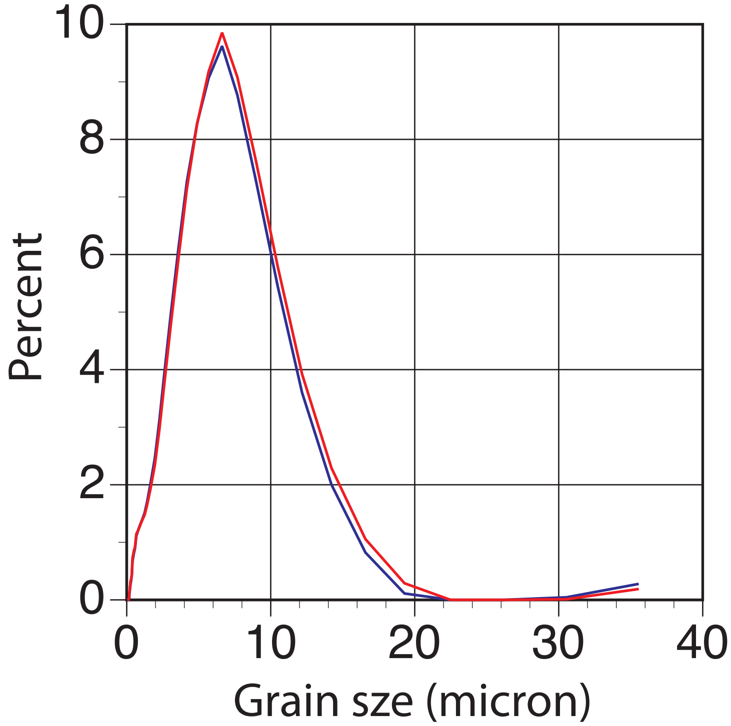
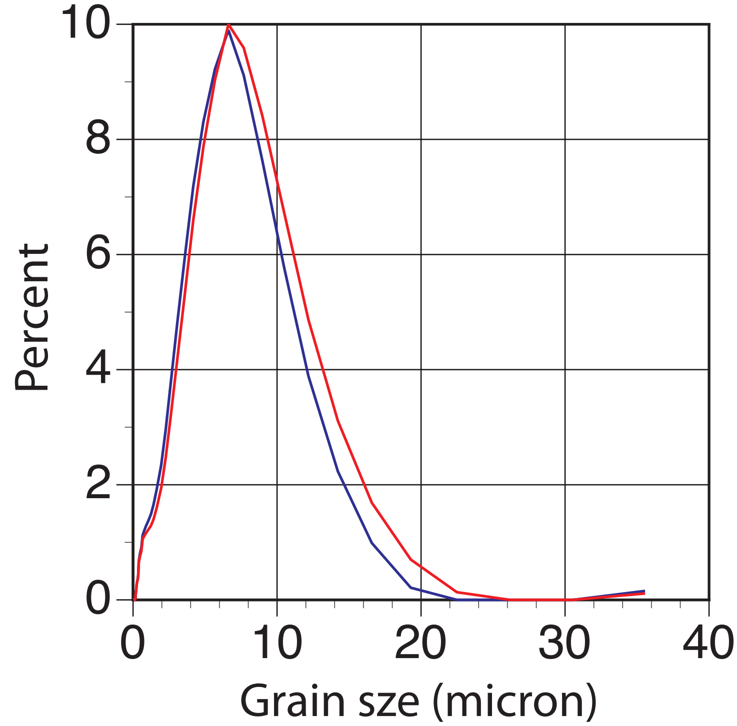

170.935 m
170.965 m
171.045 m
171.11 m
171.655 m
171.955 m
Percent
Grain size (microns)
0
5
10
15
20
25
30
35
40
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

Figure DR2c



Sample 7W, 40-41 cm



Sample 7W, 47-48 cm