The National Marine Biological
Analytical Quality Control Scheme
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Particle Size Results – PS42

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Table 1. Summary of the particle size information received from participating laboratories and replicate analysis laboratory for the forty-second particle size distribution – PS42.

Benchmark Data

Sample	Method	% Gravel	% Sand	% Silt	Median ϕ	Mean ϕ	Sediment Description (Post analysis)
PS42 60	NMBAQC	99.25	0.75	0.00	-3.00	-2.91	Gravel
PS42 61	NMBAQC	99.44	0.56	0.00	-2.99	-2.93	Gravel
PS42 62	NMBAQC	99.35	0.65	0.00	-2.98	-2.90	Gravel
PS42 63	NMBAQC	99.27	0.73	0.00	-2.97	-2.92	Gravel
PS42 64	NMBAQC	99.46	0.54	0.00	-3.03	-2.98	Gravel
PS42 65	NMBAQC	99.30	0.70	0.00	-3.01	-2.95	Gravel
PS42 66	NMBAQC	99.28	0.72	0.00	-2.98	-2.91	Gravel
PS42 67	NMBAQC	99.21	0.79	0.00	-2.94	-2.91	Gravel
PS42 68	NMBAQC	99.18	0.82	0.00	-2.93	-2.90	Gravel
PS42 69	NMBAQC	99.26	0.74	0.00	-3.00	-2.95	Gravel
TUM AVERAGE	NMBAQC	99.30	0.70	0.00	-2.98	-2.93	Gravel

Participant Data

Lab	Method	% Gravel	% Sand	% Silt	Sediment Description (Post analysis)
LB_1801	NMBAQC	99.43	0.57	0.00	Gravel
LB_1802	NMBAQC	99.31	0.69	0.00	Gravel
LB_1803	NMBAQC	99.19	0.81	0.00	Gravel
LB_1804	NMBAQC	99.32	0.61	0.07	Gravel
LB_1806	NMBAQC	99.40	0.60	0.00	Gravel
LB_1809	NMBAQC	99.41	0.59	0.00	Gravel
LB_1811	NMBAQC	98.64	1.23	0.13	Gravel
LB_1814	OTHER	99.29	0.71	0.00	Gravel
LB_1816	NMBAQC	100.00	0.00	0.00	Moderately Well Sorted Fine Gravel
LB_1818	NMBAQC	99.61	0.39	0.00	Gravel
LB_1830	OTHER	99.39	0.61	0.00	Gravel

Key to methods

NMBAQC - States following NMBAQC PSA SOP for supporting biological data.

OTHER - Following a different SOP.

Figure 1. Particle size distribution curves resulting from analysis of ten replicate samples of sediment distributed as PS42 (Benchmark Data).

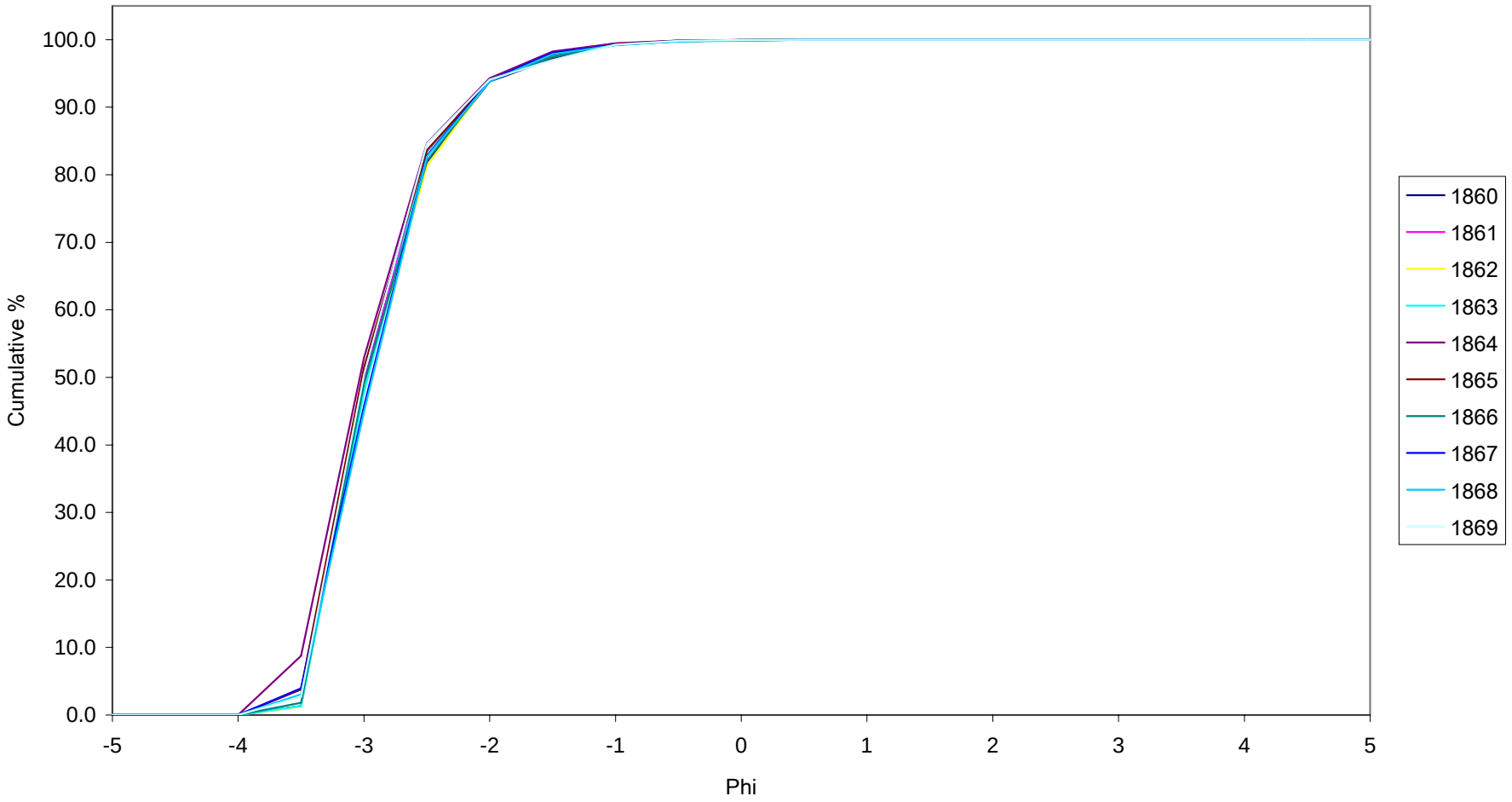


Figure 2. Particle size distribution curves from all participating laboratories for sediment samples distributed as PS42.

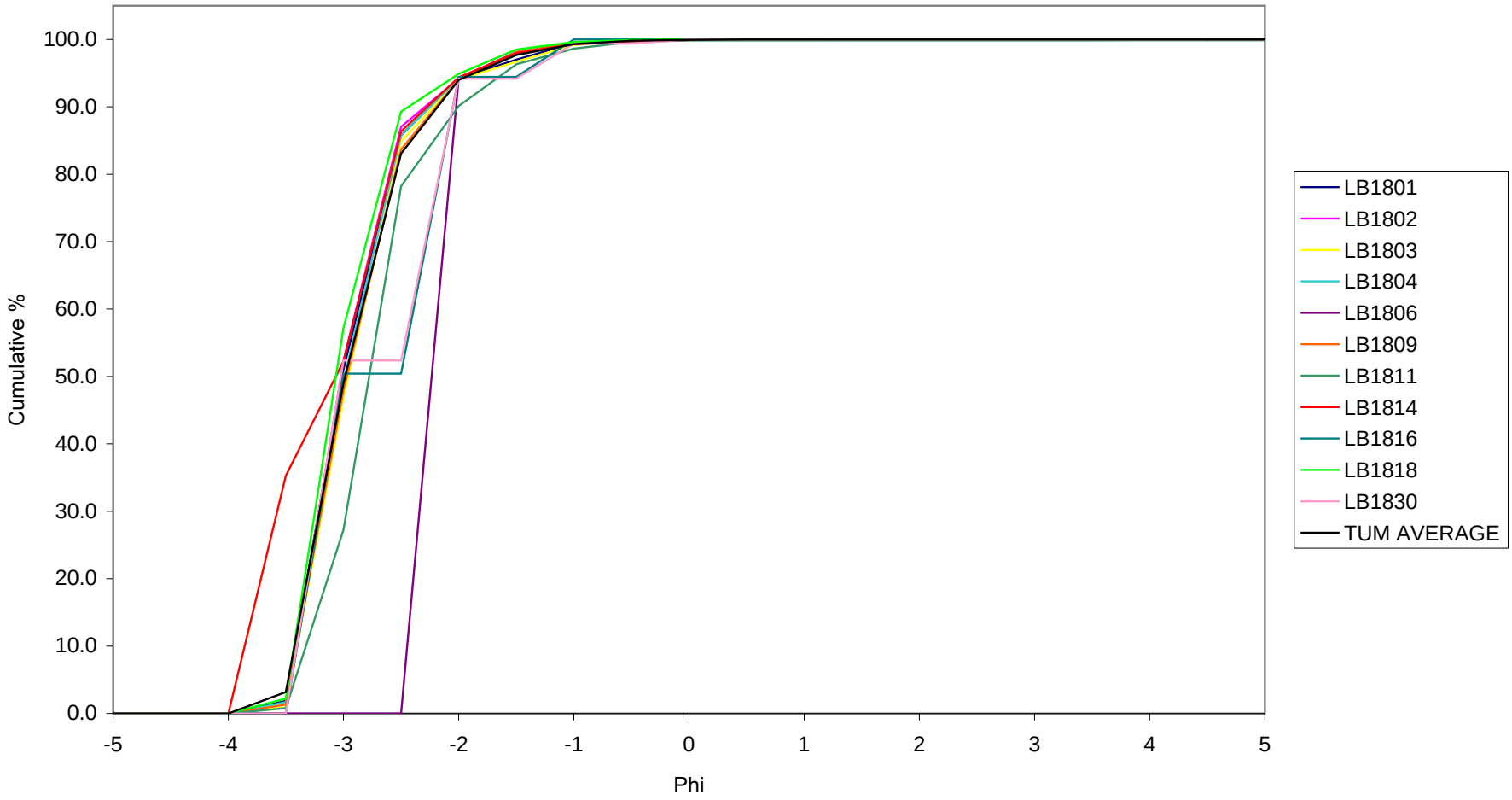


Table 2. Summary of z-scores for each phi-interval for PS42; data from all participating laboratories included in mean and standard deviation calculations.

	-6.50 to -6.00	-6.00 to -5.50	-5.50 to -5.00	-5.00 to -4.50	-4.50 to -4.00	-4.00 to -3.50	-3.50 to -3.00	-3.00 to -2.50	-2.50 to -2.00	-2.00 to -1.50	-1.50 to -1.00	-1.00 to -0.50	-0.50 to 0.00	0.00 to 0.50	0.50 to 1.00	1.00 to 1.50	1.50 to 2.00	2.00 to 2.50	2.50 to 3.00	3.00 to 3.50
TUM AVERAGE	0.00	0.00	0.00	0.00	0.00	-0.08	0.31	0.39	-0.43	0.32	-0.46	0.36	-0.50	4.35	-0.42	-0.47	-0.54	-0.54	-0.57	-0.51
LB_1801	0.00	0.00	0.00	0.00	0.00	-0.21	0.50	0.43	-0.52	-0.20	0.06	-0.41	0.50	-0.30	-0.42	-0.47	-0.54	-0.54	-0.57	-0.51
LB_1802	0.00	0.00	0.00	0.00	0.00	-0.38	0.68	0.43	-0.56	0.36	-0.61	0.60	-0.58	-0.30	-0.42	-0.47	-0.54	-0.54	-0.57	-0.51
LB_1803	0.00	0.00	0.00	0.00	0.00	-0.30	0.32	0.61	-0.49	-0.26	0.10	0.86	-0.26	-0.30	-0.42	-0.47	-0.54	-0.54	-0.57	-0.51
LB_1804	0.00	0.00	0.00	0.00	0.00	-0.22	0.41	0.53	-0.52	0.36	-0.63	-0.38	0.49	-0.30	1.10	2.16	1.96	1.00	1.74	2.07
LB_1806	0.00	0.00	0.00	0.00	0.00	-0.38	-2.26	-1.50	2.61	0.45	-0.67	0.30	-0.56	-0.30	-0.42	-0.47	-0.54	-0.54	-0.57	-0.51
LB_1809	0.00	0.00	0.00	0.00	0.00	-0.26	0.36	0.49	-0.45	0.53	-0.66	-0.02	-0.04	-0.30	-0.42	-0.47	-0.54	-0.54	-0.57	-0.51
LB_1811	0.00	0.00	0.00	0.00	0.00	-0.31	-0.78	1.33	-0.39	1.72	0.00	2.08	0.07	-0.30	-0.42	-0.28	0.51	0.94	1.81	1.91
LB_1814	0.00	0.00	0.00	0.00	0.00	3.01	-1.31	0.40	-0.53	0.27	-0.64	0.13	-0.10	3.02	2.68	1.87	1.88	2.40	1.03	0.11
LB_1816	0.00	0.00	0.00	0.00	0.00	-0.38	0.57	-1.50	0.78	-1.74	2.03	-1.42	-1.29	-0.30	-0.42	-0.47	-0.54	-0.54	-0.57	-0.51
LB_1818	0.00	0.00	0.00	0.00	0.00	-0.17	0.83	0.28	-0.62	0.28	-0.77	-0.33	-0.79	-0.30	-0.42	-0.47	-0.54	-0.54	-0.57	-0.51
LB_1830	0.00	0.00	0.00	0.00	0.00	-0.38	0.68	-1.50	0.70	-1.74	1.80	-1.42	2.55	-0.30	-0.42	-0.47	-0.54	-0.54	-0.57	-0.51
μ	0.0000	0.0000	0.0000	0.0000	0.0000	4.0054	40.2749	26.9738	22.6530	3.1151	2.3401	0.4016	0.2059	0.0046	0.0011	0.0011	0.0009	0.0009	0.0007	0.0010
σ	0.0000	0.0000	0.0000	0.0000	0.0000	10.4055	17.8193	18.0056	27.4596	1.7886	1.5925	0.2831	0.1602	0.0153	0.0027	0.0024	0.0017	0.0016	0.0012	0.0019

	3.50 to 4.00	4.00 to 4.50	4.50 to 5.00	5.00 to 5.50	5.50 to 6.00	6.00 to 6.50	6.50 to 7.00	7.00 to 7.50	7.50 to 8.00	8.00 to 8.50	8.50 to 9.00	9.00 to 9.50	9.50 to 10.00	10.00 to 10.50	10.50 to 11.00	11.00 to 11.50	11.50 to 12.00	12.00 to 12.50	12.50 to 13.00	13.00 to 13.50
TUM AVERAGE	-0.48	-0.45	-0.45	-0.45	-0.43	-0.41	-0.40	-0.40	-0.40	-0.40	-0.40	-0.39	-0.40	-0.41	-0.42	-0.43	0.00	0.00	0.00	0.00
LB_1801	-0.48	-0.45	-0.45	-0.45	-0.43	-0.41	-0.40	-0.40	-0.40	-0.40	-0.40	-0.39	-0.40	-0.41	-0.42	-0.43	0.00	0.00	0.00	0.00
LB_1802	-0.48	-0.45	-0.45	-0.45	-0.43	-0.41	-0.40	-0.40	-0.40	-0.40	-0.40	-0.39	-0.40	-0.41	-0.42	-0.43	0.00	0.00	0.00	0.00
LB_1803	-0.48	-0.45	-0.45	-0.45	-0.43	-0.41	-0.40	-0.40	-0.40	-0.40	-0.40	-0.39	-0.40	-0.41	-0.42	-0.43	0.00	0.00	0.00	0.00
LB_1804	2.21	2.22	2.13	1.75	1.26	0.94	0.82	0.79	0.76	0.79	0.75	0.68	0.76	0.85	1.07	1.28	0.00	0.00	0.00	0.00
LB_1806	-0.48	-0.45	-0.45	-0.45	-0.43	-0.41	-0.40	-0.40	-0.40	-0.40	-0.40	-0.39	-0.40	-0.41	-0.42	-0.43	0.00	0.00	0.00	0.00
LB_1809	-0.48	-0.45	-0.45	-0.45	-0.43	-0.41	-0.40	-0.40	-0.40	-0.40	-0.40	-0.39	-0.40	-0.41	-0.42	-0.43	0.00	0.00	0.00	0.00
LB_1811	1.81	1.81	1.91	2.27	2.60	2.76	2.80	2.82	2.83	2.82	2.83	2.86	2.83	2.79	2.70	2.59	0.00	0.00	0.00	0.00
LB_1814	-0.20	-0.45	-0.45	-0.45	-0.43	-0.41	-0.40	-0.40	-0.40	-0.40	-0.40	-0.39	-0.40	-0.41	-0.42	-0.43	0.00	0.00	0.00	0.00
LB_1816	-0.48	-0.45	-0.45	-0.45	-0.43	-0.41	-0.40	-0.40	-0.40	-0.40	-0.40	-0.39	-0.40	-0.41	-0.42	-0.43	0.00	0.00	0.00	0.00
LB_1818	-0.48	-0.45	-0.45	-0.45	-0.43	-0.41	-0.40	-0.40	-0.40	-0.40	-0.40	-0.39	-0.40	-0.41	-0.42	-0.43	0.00	0.00	0.00	0.00
LB_1830	-0.48	-0.45	-0.45	-0.45	-0.43	-0.41	-0.40	-0.40	-0.40	-0.40	-0.40	-0.39	-0.40	-0.41	-0.42	-0.43	0.00	0.00	0.00	0.00
μ	0.0013	0.0016	0.0016	0.0016	0.0015	0.0015	0.0015	0.0015	0.0015	0.0014	0.0013	0.0011	0.0009	0.0008	0.0005	0.0002	0.0000	0.0000	0.0000	0.0000
σ	0.0028	0.0035	0.0036	0.0036	0.0036	0.0037	0.0037	0.0037	0.0037	0.0035	0.0032	0.0029	0.0023	0.0020	0.0013	0.0005	0.0000	0.0000	0.0000	0.0000

z-score >1.96 or <-1.96

Figure 3. Summary of z-scores for the Benchmark Data (TUM AVERAGE); when data from all participating laboratories are included in mean and standard deviation calculations.

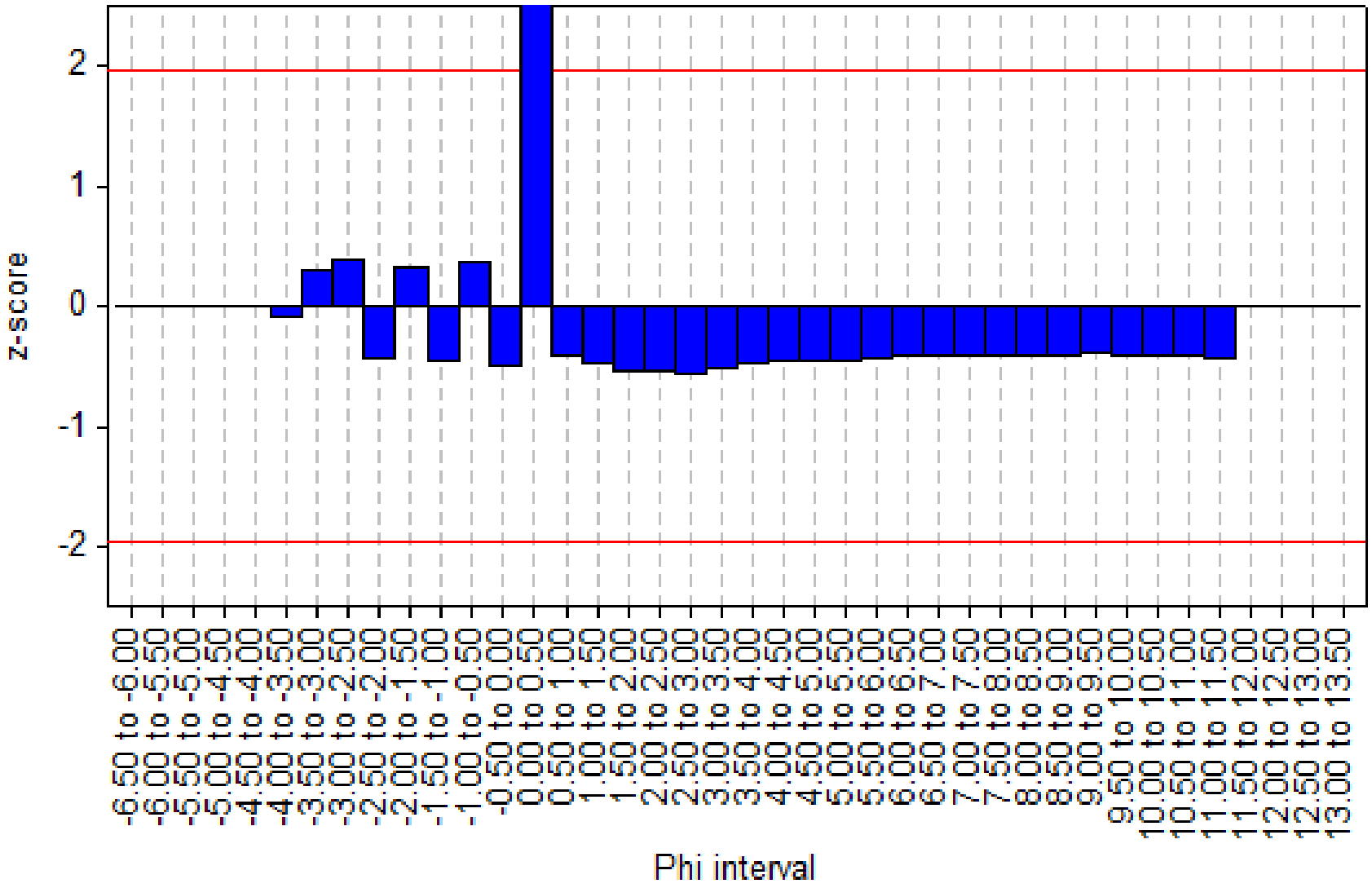
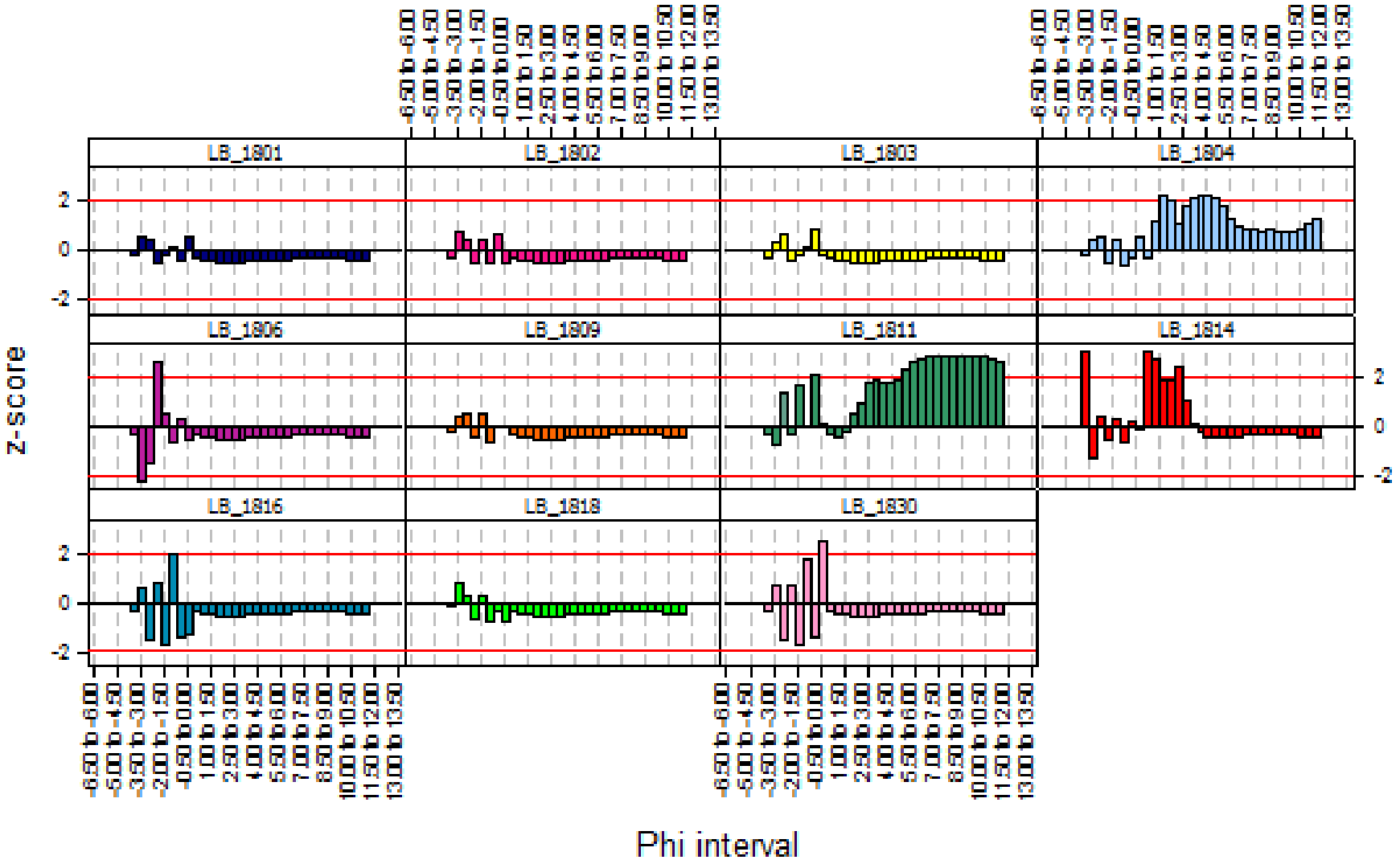


Figure 4. Summary of z-scores for each half phi interval; when data from all laboratories are included in mean and standard deviation calculations.



Results of SIMPROF testing on PSA Ring test PS42 data

Data was entered into PRIMER v. 6.1.13 in half-phi intervals; any missing data was entered as zero. The data did not need to be transformed as all data was on a similar percentage scale. A Euclidean distance matrix was created from the data; The Euclidean distance between two samples (labs) *j* and *k,* is defined algebraically as $d_{jk} = \sqrt{\sum_{i=1}^{p} (y_{ij} - y_{ik})^2}$. From this distance matrix cluster analysis was carried out including a SIMPROF test at a 5% significance level. The red SIMPROF lines on the dendrogram indicate labs that cannot be distinguished from each other at the 5% significance level; the black lines indicate labs that can be distinguished from each other. The results are presented as a cluster dendrogram (Figure 5) and non-metric Multi-Dimensional Scaling (MDS) diagrams (Figure 6) below. It is important to note that, although the MDS plot is bounded by a box, the box does not represent either axes or scale. Two samples with a high similarity index will appear close together while those less similar will appear further apart. The 'correct' configuration of sample points will be multidimensional and the plot represents the best 2-dimensional solution to the problem. The technique should be viewed as complementary to cluster analysis, offering a different perspective of the same information.

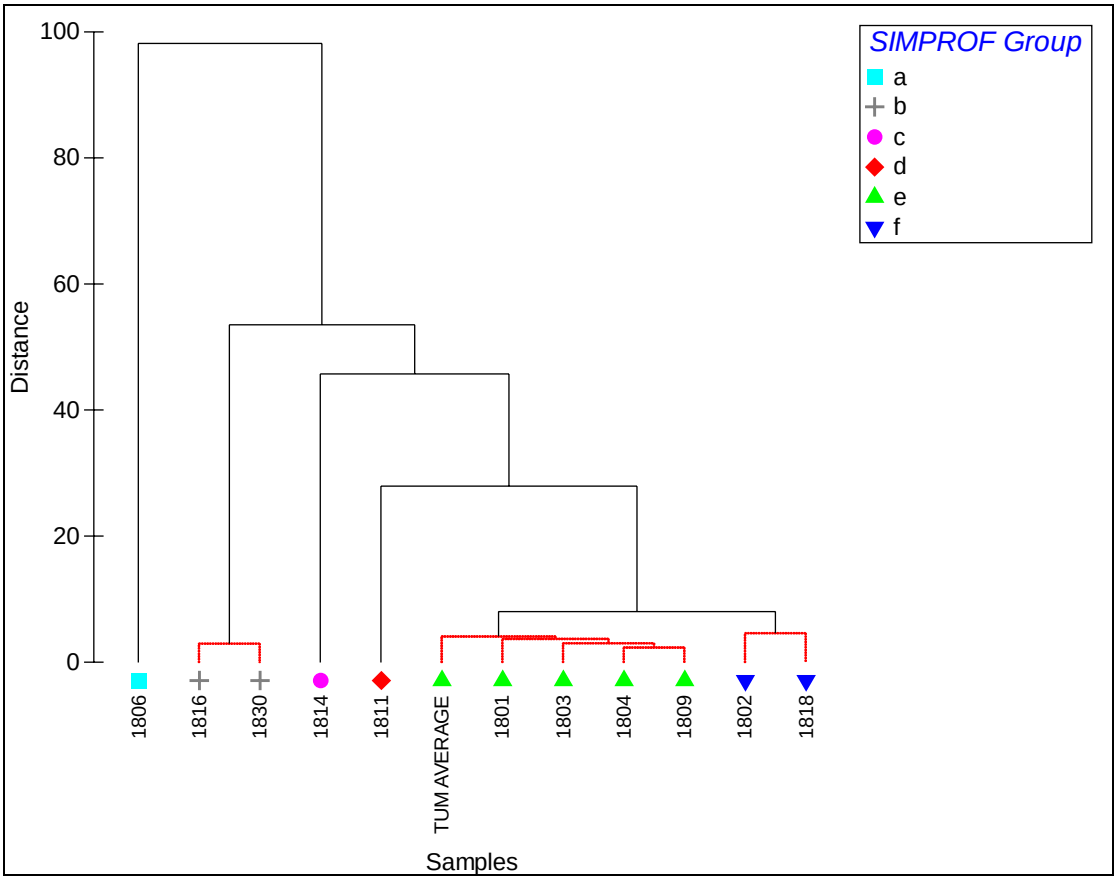


Figure 5.Cluster dendrogram of PS42 including all labs, with the benchmark replicates (TUM AVERAGE) averaged.

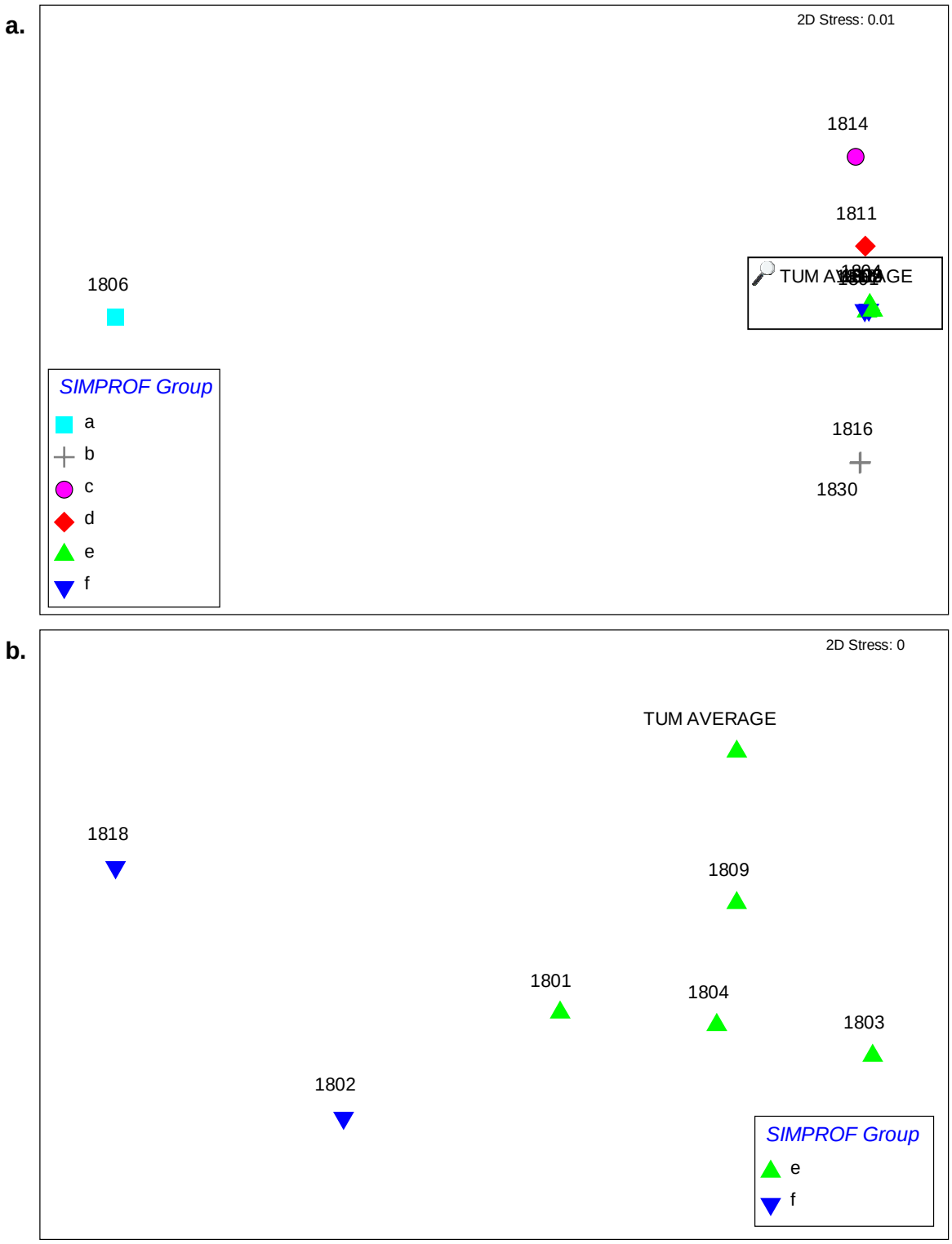


Figure 6. MDS plots of PS42 with the benchmark replicates (TUM AVERAGE) averaged; (a) including all labs and (b) sub-set of the data boxed in 6a.

The dendrogram in figure 5 shows that LB1802 and LB1818 cannot be separated at the 5% level. These two labs are closely linked to LB1801, LB1803, LB1804, LB1809 and the benchmark data (TUM AVERAGE) which also cannot be distinguished from each other. The graph in figure 2 shows that these seven labs follow very similar cumulative percentage curves.

LB1816 and LB1830 cannot be distinguished at the 5% level, figure 2 and the LB1816 and LB1830 lab data sheets in appendix 1 show that both these labs did not use half-phi intervals as '0' has been entered for alternate entries, this is shown in figure 2 where the cumulative percentage graphs plateau for a half-phi interval indicating that nothing was recorded for that interval.

LB1806 forms its own cluster group. Figures 5 and 6 show that LB1806 has been separated away from the other labs, figure 2 shows that LB1806's cumulative percentage curve is different to the other labs. The LB1806 data sheet in appendix 1 shows that the displacement of their curve is due to no data being recorded greater than -2.5 ϕ (5.6mm).

LB1814 and LB1811 also grouped into separate cluster groups, their cumulative percentage curves (figure 2) are different form the majority of the other labs but not as dramatically as that of LB1806. The LB1811 data sheet in appendix 1 shows that LB1811 only analysed 202.81g of the replicate that should have weighed ~520g. The LB1811 data sheet also showed that laser analysis had been carried out that was not required. LB1814 have followed an alternative method to the NMBSQC PSA SOP, their cumulative percentage curve in figure 2 shows that the results for -4.0 to -3.5 and -3.5 to -3.0 differ from the majority of labs but after this point it follows the same curve.

Appendices

Appendix 1. Final Summary Data sheets as supplied by participating laboratories (arranged by Lab Code).

Exercise Code:	**PS42**
LabCode:	**LB1801**
Sample Code:	**PS421801**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**9.7000**
-3.50 to -3.00; 8 mm	**255.6700**
-3.00 to -2.50; 5.6 mm	**180.4600**
-2.50 to -2.00; 4 mm	**44.0400**
-2.00 to -1.50; 2.8 mm	**14.3200**
-1.50 to -1.00; 2 mm	**12.6300**
-1.00 to -0.50; 1.4 mm	**1.4800**
-0.50 to 0.00; 1 mm	**1.4900**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0000
1.00 to 1.50; (353.6 µm)	0.0000
1.50 to 2.00; (250 µm)	0.0000
2.00 to 2.50; (176.8 µm)	0.0000
2.50 to 3.00; (125 µm)	0.0000
3.00 to 3.50; (88.39 µm)	0.0000
3.50 to 4.00; (62.5 µm)	0.0000
4.00 to 4.50; (44.19 µm)	0.0000
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1. Final Summary Data sheets as supplied by participating laboratories (arranged by Lab Code).

Exercise Code:	**PS42**
LabCode:	**LB1802**
Sample Code:	**PS421802**

Phi interval (explicit) **+ sieve mesh (theoretical sieves shown in brackets)**	**Volume/Weight** **(mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**272.3000**
-3.00 to -2.50; 5.6 mm	**180.7800**
-2.50 to -2.00; 4 mm	**37.1900**
-2.00 to -1.50; 2.8 mm	**19.5500**
-1.50 to -1.00; 2 mm	**7.1600**
-1.00 to -0.50; 1.4 mm	**2.9800**
-0.50 to 0.00; 1 mm	**0.5900**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0000
1.00 to 1.50; (353.6 µm)	0.0000
1.50 to 2.00; (250 µm)	0.0000
2.00 to 2.50; (176.8 µm)	0.0000
2.50 to 3.00; (125 µm)	0.0000
3.00 to 3.50; (88.39 µm)	0.0000
3.50 to 4.00; (62.5 µm)	0.0000
4.00 to 4.50; (44.19 µm)	0.0000
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1. Final Summary Data sheets as supplied by participating laboratories (arranged by Lab Code).

Exercise Code:	**PS42**
LabCode:	**LB1803**
Sample Code:	**PS421803**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**4.6900**
-3.50 to -3.00; 8 mm	**238.8900**
-3.00 to -2.50; 5.6 mm	**196.6000**
-2.50 to -2.00; 4 mm	**47.6900**
-2.00 to -1.50; 2.8 mm	**13.7100**
-1.50 to -1.00; 2 mm	**13.0000**
-1.00 to -0.50; 1.4 mm	**3.3500**
-0.50 to 0.00; 1 mm	**0.8500**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0000
1.00 to 1.50; (353.6 µm)	0.0000
1.50 to 2.00; (250 µm)	0.0000
2.00 to 2.50; (176.8 µm)	0.0000
2.50 to 3.00; (125 µm)	0.0000
3.00 to 3.50; (88.39 µm)	0.0000
3.50 to 4.00; (62.5 µm)	0.0000
4.00 to 4.50; (44.19 µm)	0.0000
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1. Final Summary Data sheets as supplied by participating laboratories (arranged by Lab Code).

Exercise Code:	**PS42**
LabCode:	**LB1804**
Sample Code:	**PS421804**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**8.7700**
-3.50 to -3.00; 8 mm	**248.0500**
-3.00 to -2.50; 5.6 mm	**189.9200**
-2.50 to -2.00; 4 mm	**43.9000**
-2.00 to -1.50; 2.8 mm	**19.5600**
-1.50 to -1.00; 2 mm	**6.9600**
-1.00 to -0.50; 1.4 mm	**1.5300**
-0.50 to 0.00; 1 mm	**1.4800**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0212
1.00 to 1.50; (353.6 µm)	0.0327
1.50 to 2.00; (250 µm)	0.0228
2.00 to 2.50; (176.8 µm)	0.0131
2.50 to 3.00; (125 µm)	0.0144
3.00 to 3.50; (88.39 µm)	0.0251
3.50 to 4.00; (62.5 µm)	0.0389
4.00 to 4.50; (44.19 µm)	0.0486
4.50 to 5.00; (31.25 µm)	0.0488
5.00 to 5.50; (22.097 µm)	0.0410
5.50 to 6.00; (15.625 µm)	0.0317
6.00 to 6.50; (11.049 µm)	0.0258
6.50 to 7.00; (7.813 µm)	0.0233
7.00 to 7.50; (5.524 µm)	0.0232
7.50 to 8.00; (3.906 µm)	0.0222
8.00 to 8.50; (2.762 µm)	0.0216
8.50 to 9.00; (1.953 µm)	0.0193
9.00 to 9.50; (1.381 µm)	0.0161
9.50 to 10.00; (0.977 µm)	0.0136
10.00 to 10.50; (0.691 µm)	0.0128
10.50 to 11.00; (0.488 µm)	0.0099
11.00 to 11.50; (0.345 µm)	0.0044
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1. Final Summary Data sheets as supplied by participating laboratories (arranged by Lab Code).

Exercise Code:	**PS42**
LabCode:	**LB1806**
Sample Code:	**PS421806**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**0.0000**
-3.00 to -2.50; 5.6 mm	**0.0000**
-2.50 to -2.00; 4 mm	**489.5000**
-2.00 to -1.50; 2.8 mm	**20.3300**
-1.50 to -1.00; 2 mm	**6.5900**
-1.00 to -0.50; 1.4 mm	**2.5300**
-0.50 to 0.00; 1 mm	**0.6000**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0000
1.00 to 1.50; (353.6 µm)	0.0000
1.50 to 2.00; (250 µm)	0.0000
2.00 to 2.50; (176.8 µm)	0.0000
2.50 to 3.00; (125 µm)	0.0000
3.00 to 3.50; (88.39 µm)	0.0000
3.50 to 4.00; (62.5 µm)	0.0000
4.00 to 4.50; (44.19 µm)	0.0000
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1. Final Summary Data sheets as supplied by participating laboratories (arranged by Lab Code).

Exercise Code:	**PS42**
LabCode:	**LB1809**
Sample Code:	**PS421809**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**6.8800**
-3.50 to -3.00; 8 mm	**242.1900**
-3.00 to -2.50; 5.6 mm	**185.4800**
-2.50 to -2.00; 4 mm	**53.9300**
-2.00 to -1.50; 2.8 mm	**21.0600**
-1.50 to -1.00; 2 mm	**6.7300**
-1.00 to -0.50; 1.4 mm	**2.0500**
-0.50 to 0.00; 1 mm	**1.0400**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0000
1.00 to 1.50; (353.6 µm)	0.0000
1.50 to 2.00; (250 µm)	0.0000
2.00 to 2.50; (176.8 µm)	0.0000
2.50 to 3.00; (125 µm)	0.0000
3.00 to 3.50; (88.39 µm)	0.0000
3.50 to 4.00; (62.5 µm)	0.0000
4.00 to 4.50; (44.19 µm)	0.0000
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1. Final Summary Data sheets as supplied by participating laboratories (arranged by Lab Code).

Exercise Code:	**PS42**
LabCode:	**LB1811**
Sample Code:	**PS421811**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**1.6100**
-3.50 to -3.00; 8 mm	**53.6500**
-3.00 to -2.50; 5.6 mm	**103.3800**
-2.50 to -2.00; 4 mm	**24.1300**
-2.00 to -1.50; 2.8 mm	**12.5400**
-1.50 to -1.00; 2 mm	**4.7400**
-1.00 to -0.50; 1.4 mm	**2.0100**
-0.50 to 0.00; 1 mm	**0.4400**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0000
1.00 to 1.50; (353.6 µm)	0.0009
1.50 to 2.00; (250 µm)	0.0037
2.00 to 2.50; (176.8 µm)	0.0049
2.50 to 3.00; (125 µm)	0.0058
3.00 to 3.50; (88.39 µm)	0.0092
3.50 to 4.00; (62.5 µm)	0.0129
4.00 to 4.50; (44.19 µm)	0.0160
4.50 to 5.00; (31.25 µm)	0.0173
5.00 to 5.50; (22.097 µm)	0.0198
5.50 to 6.00; (15.625 µm)	0.0221
6.00 to 6.50; (11.049 µm)	0.0236
6.50 to 7.00; (7.813 µm)	0.0238
7.00 to 7.50; (5.524 µm)	0.0245
7.50 to 8.00; (3.906 µm)	0.0242
8.00 to 8.50; (2.762 µm)	0.0226
8.50 to 9.00; (1.953 µm)	0.0211
9.00 to 9.50; (1.381 µm)	0.0190
9.50 to 10.00; (0.977 µm)	0.0148
10.00 to 10.50; (0.691 µm)	0.0127
10.50 to 11.00; (0.488 µm)	0.0081
11.00 to 11.50; (0.345 µm)	0.0030
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1. Final Summary Data sheets as supplied by participating laboratories (arranged by Lab Code).

Exercise Code:	**PS42**
LabCode:	**LB1814**
Sample Code:	**PS421814**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	0.00
-6.00 to -5.50; 45 mm	0.00
-5.50 to -5.00; 31.5 mm	0.00
-5.00 to -4.50; 22.4 mm	0.00
-4.50 to -4.00; 16 mm	0.00
-4.00 to -3.50; 11.2 mm	35.28
-3.50 to -3.00; 8 mm	16.96
-3.00 to -2.50; 5.6 mm	34.12
-2.50 to -2.00; 4 mm	8.03
-2.00 to -1.50; 2.8 mm	3.59
-1.50 to -1.00; 2 mm	1.32
-1.00 to -0.50; 1.4 mm	0.44
-0.50 to 0.00; 1 mm	0.19
0.00 to 0.50; (707 µm)	0.05
0.50 to 1.00; (500 µm)	0.01
1.00 to 1.50; (353.6 µm)	0.01
1.50 to 2.00; (250 µm)	0.004
2.00 to 2.50; (176.8 µm)	0.005
2.50 to 3.00; (125 µm)	0.002
3.00 to 3.50; (88.39 µm)	0.001
3.50 to 4.00; (62.5 µm)	0.0008
4.00 to 4.50; (44.19 µm)	0.0008
4.50 to 5.00; (31.25 µm)	-
5.00 to 5.50; (22.097 µm)	-
5.50 to 6.00; (15.625 µm)	-
6.00 to 6.50; (11.049 µm)	-
6.50 to 7.00; (7.813 µm)	-
7.00 to 7.50; (5.524 µm)	-
7.50 to 8.00; (3.906 µm)	-
8.00 to 8.50; (2.762 µm)	-
8.50 to 9.00; (1.953 µm)	-
9.00 to 9.50; (1.381 µm)	-
9.50 to 10.00; (0.977 µm)	-
10.00 to 10.50; (0.691 µm)	-
10.50 to 11.00; (0.488 µm)	-
11.00 to 11.50; (0.345 µm)	-
>11.50; (0.244 µm)	-

Appendix 1. Final Summary Data sheets as supplied by participating laboratories (arranged by Lab Code).

Exercise Code:	**PS42**
LabCode:	**LB1816**
Sample Code:	**PS421816**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**257.5200**
-3.00 to -2.50; 5.6 mm	**0.0000**
-2.50 to -2.00; 4 mm	**224.6900**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**28.4200**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0000
1.00 to 1.50; (353.6 µm)	0.0000
1.50 to 2.00; (250 µm)	0.0000
2.00 to 2.50; (176.8 µm)	0.0000
2.50 to 3.00; (125 µm)	0.0000
3.00 to 3.50; (88.39 µm)	0.0000
3.50 to 4.00; (62.5 µm)	0.0000
4.00 to 4.50; (44.19 µm)	0.0000
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1. Final Summary Data sheets as supplied by participating laboratories (arranged by Lab Code).

Exercise Code:	**PS42**
LabCode:	**LB1818**
Sample Code:	**PS421818**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**11.4300**
-3.50 to -3.00; 8 mm	**285.1400**
-3.00 to -2.50; 5.6 mm	**166.3800**
-2.50 to -2.00; 4 mm	**29.0200**
-2.00 to -1.50; 2.8 mm	**18.7400**
-1.50 to -1.00; 2 mm	**5.7500**
-1.00 to -0.50; 1.4 mm	**1.6000**
-0.50 to 0.00; 1 mm	**0.4100**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0000
1.00 to 1.50; (353.6 µm)	0.0000
1.50 to 2.00; (250 µm)	0.0000
2.00 to 2.50; (176.8 µm)	0.0000
2.50 to 3.00; (125 µm)	0.0000
3.00 to 3.50; (88.39 µm)	0.0000
3.50 to 4.00; (62.5 µm)	0.0000
4.00 to 4.50; (44.19 µm)	0.0000
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1. Final Summary Data sheets as supplied by participating laboratories (arranged by Lab Code).

Exercise Code:	**PS42**
LabCode:	**LB1830**
Sample Code:	**PS421830**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**272.9000**
-3.00 to -2.50; 5.6 mm	**0.0000**
-2.50 to -2.00; 4 mm	**217.9000**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**27.1000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**3.2000**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0000
1.00 to 1.50; (353.6 µm)	0.0000
1.50 to 2.00; (250 µm)	0.0000
2.00 to 2.50; (176.8 µm)	0.0000
2.50 to 3.00; (125 µm)	0.0000
3.00 to 3.50; (88.39 µm)	0.0000
3.50 to 4.00; (62.5 µm)	0.0000
4.00 to 4.50; (44.19 µm)	0.0000
4.50 to 5.00; (31.25 µm)	0.0000
5.00 to 5.50; (22.097 µm)	0.0000
5.50 to 6.00; (15.625 µm)	0.0000
6.00 to 6.50; (11.049 µm)	0.0000
6.50 to 7.00; (7.813 µm)	0.0000
7.00 to 7.50; (5.524 µm)	0.0000
7.50 to 8.00; (3.906 µm)	0.0000
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 2. Z-score calculations when data from all participating laboratories are included in mean and standard deviation calculations.

	-6.50 to -6.00	-6.00 to -5.50	-5.50 to -5.00	-5.00 to -4.50	-4.50 to -4.00	-4.00 to -3.50	z-score	-3.50 to -3.00	z-score	-3.00 to -2.50	z-score	-2.50 to -2.00	z-score
TUM AVERAGE	0.000	0.000	0.000	0.000	0.000	3.175	-0.08	45.830	0.31	34.058	0.39	10.940	-0.43
LB1801	0.000	0.000	0.000	0.000	0.000	1.866	-0.21	49.187	0.50	34.718	0.43	8.473	-0.52
LB1802	0.000	0.000	0.000	0.000	0.000	0.000	-0.38	52.310	0.68	34.729	0.43	7.144	-0.56
LB1803	0.000	0.000	0.000	0.000	0.000	0.904	-0.30	46.048	0.32	37.897	0.61	9.193	-0.49
LB1804	0.000	0.000	0.000	0.000	0.000	1.684	-0.22	47.638	0.41	36.474	0.53	8.431	-0.52
LB1806	0.000	0.000	0.000	0.000	0.000	0.000	-0.38	0.000	-2.26	0.000	-1.50	94.216	2.61
LB1809	0.000	0.000	0.000	0.000	0.000	1.325	-0.26	46.632	0.36	35.713	0.49	10.384	-0.45
LB1811	0.000	0.000	0.000	0.000	0.000	0.794	-0.31	26.453	-0.78	50.974	1.33	11.898	-0.39
LB1814	0.000	0.000	0.000	0.000	0.000	35.282	3.01	16.957	-1.31	34.117	0.40	8.029	-0.53
LB1816	0.000	0.000	0.000	0.000	0.000	0.000	-0.38	50.432	0.57	0.000	-1.50	44.003	0.78
LB1818	0.000	0.000	0.000	0.000	0.000	2.205	-0.17	54.996	0.83	32.091	0.28	5.597	-0.62
LB1830	0.000	0.000	0.000	0.000	0.000	0.000	-0.38	52.370	0.68	0.000	-1.50	41.815	0.70
μ	0.000	0.000	0.000	0.000	0.000	4.0054		40.2749		26.9738		22.6530	
σ	0.000	0.000	0.000	0.000	0.000	10.4055		17.8193		18.0056		27.4596	

	-2.00 to -1.50	z-score	-1.50 to -1.00	z-score	-1.00 to -0.50	z-score	-0.50 to 0.00	z-score	0.00 to 0.50	z-score	0.50 to 1.00	z-score	1.00 to 1.50	z-score
TUM AVERAGE	3.684	0.32	1.612	-0.46	0.502	0.36	0.126	-0.50	0.071	4.35	0.000	-0.42	0.0000	-0.47
LB1801	2.755	-0.20	2.430	0.06	0.285	-0.41	0.287	0.50	0.000	-0.30	0.000	-0.42	0.0000	-0.47
LB1802	3.756	0.36	1.375	-0.61	0.572	0.60	0.113	-0.58	0.000	-0.30	0.000	-0.42	0.0000	-0.47
LB1803	2.643	-0.26	2.506	0.10	0.646	0.86	0.164	-0.26	0.000	-0.30	0.000	-0.42	0.0000	-0.47
LB1804	3.756	0.36	1.337	-0.63	0.294	-0.38	0.284	0.49	0.000	-0.30	0.004	1.10	0.0063	2.16
LB1806	3.913	0.45	1.268	-0.67	0.487	0.30	0.115	-0.56	0.000	-0.30	0.000	-0.42	0.0000	-0.47
LB1809	4.055	0.53	1.296	-0.66	0.395	-0.02	0.200	-0.04	0.000	-0.30	0.000	-0.42	0.0000	-0.47
LB1811	6.183	1.72	2.337	0.00	0.991	2.08	0.217	0.07	0.000	-0.30	0.000	-0.42	0.0005	-0.28
LB1814	3.591	0.27	1.317	-0.64	0.439	0.13	0.191	-0.10	0.051	3.02	0.008	2.68	0.0056	1.87
LB1816	0.000	-1.74	5.566	2.03	0.000	-1.42	0.000	-1.29	0.000	-0.30	0.000	-0.42	0.0000	-0.47
LB1818	3.614	0.28	1.109	-0.77	0.309	-0.33	0.079	-0.79	0.000	-0.30	0.000	-0.42	0.0000	-0.47
LB1830	0.000	-1.74	5.201	1.80	0.000	-1.42	0.614	2.55	0.000	-0.30	0.000	-0.42	0.0000	-0.47
μ	3.1151		2.3401		0.4016		0.2059		0.0046		0.0011		0.0011	
σ	1.7886		1.5925		0.2831		0.1602		0.0153		0.0027		0.0024	

All z-scores equal 0

z-score >1.96 or <-1.96

Appendix 2. Z-score calculations when data from all participating laboratories are included in mean and standard deviation calculations.

	1.50 to 2.00	z-score	2.00 to 2.50	z-score	2.50 to 3.00	z-score	3.00 to 3.50	z-score	3.50 to 4.00	z-score	4.00 to 4.50	z-score	4.50 to 5.00	z-score
TUM AVERAGE	0.000	-0.54	0.000	-0.54	0.000	-0.57	0.000	-0.51	0.000	-0.48	0.000	-0.45	0.000	-0.45
LB1801	0.000	-0.54	0.000	-0.54	0.000	-0.57	0.000	-0.51	0.000	-0.48	0.000	-0.45	0.000	-0.45
LB1802	0.000	-0.54	0.000	-0.54	0.000	-0.57	0.000	-0.51	0.000	-0.48	0.000	-0.45	0.000	-0.45
LB1803	0.000	-0.54	0.000	-0.54	0.000	-0.57	0.000	-0.51	0.000	-0.48	0.000	-0.45	0.000	-0.45
LB1804	0.004	1.96	0.003	1.00	0.003	1.74	0.005	2.07	0.007	2.21	0.009	2.22	0.009	2.13
LB1806	0.000	-0.54	0.000	-0.54	0.000	-0.57	0.000	-0.51	0.000	-0.48	0.000	-0.45	0.000	-0.45
LB1809	0.000	-0.54	0.000	-0.54	0.000	-0.57	0.000	-0.51	0.000	-0.48	0.000	-0.45	0.000	-0.45
LB1811	0.002	0.51	0.002	0.94	0.003	1.81	0.005	1.91	0.006	1.81	0.008	1.81	0.009	1.91
LB1814	0.004	1.88	0.005	2.40	0.002	1.03	0.001	0.11	0.001	-0.20	0.000	-0.45	0.000	-0.45
LB1816	0.000	-0.54	0.000	-0.54	0.000	-0.57	0.000	-0.51	0.000	-0.48	0.000	-0.45	0.000	-0.45
LB1818	0.000	-0.54	0.000	-0.54	0.000	-0.57	0.000	-0.51	0.000	-0.48	0.000	-0.45	0.000	-0.45
LB1830	0.000	-0.54	0.000	-0.54	0.000	-0.57	0.000	-0.51	0.000	-0.48	0.000	-0.45	0.000	-0.45
μ	0.0009		0.0009		0.0007		0.0010		0.0013		0.0016		0.0016	
σ	0.0017		0.0016		0.0012		0.0019		0.0028		0.0035		0.0036	

	5.00 to 5.50	z-score	5.50 to 6.00	z-score	6.00 to 6.50	z-score	6.50 to 7.00	z-score	7.00 to 7.50	z-score	7.50 to 8.00	z-score	8.00 to 8.50	z-score
TUM AVERAGE	0.000	-0.45	0.000	-0.43	0.000	-0.41	0.000	-0.40	0.000	-0.40	0.000	-0.40	0.000	-0.40
LB1801	0.000	-0.45	0.000	-0.43	0.000	-0.41	0.000	-0.40	0.000	-0.40	0.000	-0.40	0.000	-0.40
LB1802	0.000	-0.45	0.000	-0.43	0.000	-0.41	0.000	-0.40	0.000	-0.40	0.000	-0.40	0.000	-0.40
LB1803	0.000	-0.45	0.000	-0.43	0.000	-0.41	0.000	-0.40	0.000	-0.40	0.000	-0.40	0.000	-0.40
LB1804	0.008	1.75	0.006	1.26	0.005	0.94	0.004	0.82	0.004	0.79	0.004	0.76	0.004	0.79
LB1806	0.000	-0.45	0.000	-0.43	0.000	-0.41	0.000	-0.40	0.000	-0.40	0.000	-0.40	0.000	-0.40
LB1809	0.000	-0.45	0.000	-0.43	0.000	-0.41	0.000	-0.40	0.000	-0.40	0.000	-0.40	0.000	-0.40
LB1811	0.010	2.27	0.011	2.60	0.012	2.76	0.012	2.80	0.012	2.82	0.012	2.83	0.011	2.82
LB1814	0.000	-0.45	0.000	-0.43	0.000	-0.41	0.000	-0.40	0.000	-0.40	0.000	-0.40	0.000	-0.40
LB1816	0.000	-0.45	0.000	-0.43	0.000	-0.41	0.000	-0.40	0.000	-0.40	0.000	-0.40	0.000	-0.40
LB1818	0.000	-0.45	0.000	-0.43	0.000	-0.41	0.000	-0.40	0.000	-0.40	0.000	-0.40	0.000	-0.40
LB1830	0.000	-0.45	0.000	-0.43	0.000	-0.41	0.000	-0.40	0.000	-0.40	0.000	-0.40	0.000	-0.40
μ	0.0016		0.0015		0.0015		0.0015		0.0015		0.0015		0.0014	
σ	0.0036		0.0036		0.0037		0.0037		0.0037		0.0037		0.0035	

All z-scores equal 0
z-score >1.96 or <-1.96

Appendix 2. Z-score calculations when data from all participating laboratories are included in mean and standard deviation calculations.

	8.50 to 9.00	z-score	9.00 to 9.50	z-score	9.50 to 10.00	z-score	10.00 to 10.50	z-score	10.50 to 11.00	z-score	11.00 to 11.50	z-score	11.50 to 12.00	12.00 to 12.50
TUM AVERAGE	0.000	-0.40	0.000	-0.39	0.000	-0.40	0.000	-0.41	0.000	-0.42	0.000	-0.43	0.000	0.000
LB1801	0.000	-0.40	0.000	-0.39	0.000	-0.40	0.000	-0.41	0.000	-0.42	0.000	-0.43	0.000	0.000
LB1802	0.000	-0.40	0.000	-0.39	0.000	-0.40	0.000	-0.41	0.000	-0.42	0.000	-0.43	0.000	0.000
LB1803	0.000	-0.40	0.000	-0.39	0.000	-0.40	0.000	-0.41	0.000	-0.42	0.000	-0.43	0.000	0.000
LB1804	0.004	0.75	0.003	0.68	0.003	0.76	0.002	0.85	0.002	1.07	0.001	1.28	0.000	0.000
LB1806	0.000	-0.40	0.000	-0.39	0.000	-0.40	0.000	-0.41	0.000	-0.42	0.000	-0.43	0.000	0.000
LB1809	0.000	-0.40	0.000	-0.39	0.000	-0.40	0.000	-0.41	0.000	-0.42	0.000	-0.43	0.000	0.000
LB1811	0.010	2.83	0.009	2.86	0.007	2.83	0.006	2.79	0.004	2.70	0.001	2.59	0.000	0.000
LB1814	0.000	-0.40	0.000	-0.39	0.000	-0.40	0.000	-0.41	0.000	-0.42	0.000	-0.43	0.000	0.000
LB1816	0.000	-0.40	0.000	-0.39	0.000	-0.40	0.000	-0.41	0.000	-0.42	0.000	-0.43	0.000	0.000
LB1818	0.000	-0.40	0.000	-0.39	0.000	-0.40	0.000	-0.41	0.000	-0.42	0.000	-0.43	0.000	0.000
LB1830	0.000	-0.40	0.000	-0.39	0.000	-0.40	0.000	-0.41	0.000	-0.42	0.000	-0.43	0.000	0.000
μ	0.0013		0.0011		0.0009		0.0008		0.0005		0.0002		0.000	0.000
σ	0.0032		0.0029		0.0023		0.0020		0.0013		0.0005		0.000	0.000

All z-scores equal 0

z-score >1.96 or <-1.96