APPENDIX I. GRAIN-SIZE ANALYSES, LEG 23

Gerald W. Bode, Scripps Institution of Oceanography, La Jolla, California

Sand-silt-clay distribution was determined on 10-cc sediment samples collected at the time the cores were split and described. Results are listed in the table below.

The sediment classification used here is that of Shepard (1954) with the sand, silt, and clay boundaries based on the Wentworth (1922) scale (Figure 1). Thus the sand, silt, and clay fractions are composed of particles whose diameters range from 2000 to 62.5 microns, 62.5 to 3.91 microns, and less than 3.91 microns, respectively. This classification is applied regardless of sediment type and origin; therefore, the sediment names used in this table may differ from those used elsewhere in this volume, e.g., a silt composed of nannofossils in this table may be called a nanno ooze in a site chapter.

Standard sieve and pipette methods were used to determine the grain-size distribution. The sediment sample was dried and dispersed in a Calgon solution. If a sediment sample failed to disaggregate, it was treated with a sonic probe and, if necessary, hydrogen peroxide. Sediment samples which resisted the above treatment were not analyzed.

The sand fraction was removed by wet sieving using a 63-micron sieve, and the silt and clay fractions were analyzed by standard pipette analysis. Sampling depths and times were calculated using equations derived from Stokes settling velocity equation (Krumbein and Pettijohn, 1938, p. 95-96):

$$\frac{D}{t} = V = \frac{2(d_1-d_2)gr^2}{9\eta}$$

$$t = \frac{9D\eta}{2gr^2(d_1-d_2)}$$

where

V = velocity in cm/s
t = time in seconds*
D = depth pipette is inserted, in cm
g = gravity in cm/sec^2*
r = radius of individual particles in cm*
d_1 = density of solid particles arbitrarily set at 2.675 gm/cc
d_2 = absolute density of distilled water at different = temperatures (Hodsman et al., 1960, p. 2129)
η = viscosity of distilled water in poises at different = temperatures (Hodsman et al., 1960, p. 2181).*

The reproducibility of the grain-size analysis has been previously tested (Boyce, 1972), and it was found that over a period of time with several operators the reproducibility for the sand-silt-clay fractions is ±2.5% (absolute). For detailed step-by-step procedures see Volume IV of the Initial Reports of the Deep Sea Drilling Project.

*Five figures were used in calculations to avoid rounding off variations.

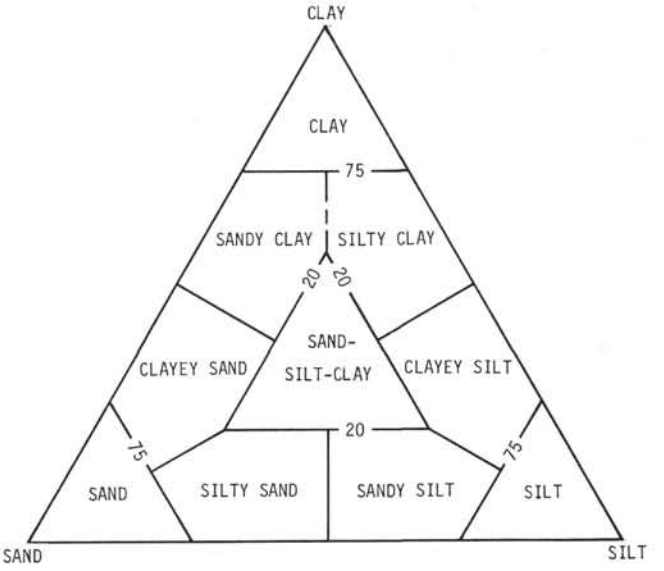

Figure 1. *Sediment classification after Shepard (1954) with the sand, silt, and clay-size fractions based on the Wentworth (1932) Grade Scale: Sand, silt, and clay-size particles having respective diameters of 2,000 to 62.5 microns, 62.5 to 3.91 microns, and less than 3.91 microns. Shepard's (1954) sediment classification is a function of sand, silt, and clay-size percentages and not composition.*

Grain-size data presented in the following table is in two parts. Part 1 contains data from the DSDP Shore-Based Laboratory and Part 2 shows the results of an analysis by D. C. Jipa.

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Part 1 – DSDP Shore-Based Laboratory Grain-Size Data

Core, Section, Top of Interval (cm)	Subbottom Depth (m)	Sand (%)	Silt (%)	Clay (%)	Classific Classification
Hole 219					
1-1, 53	0.5	11.6	34.8	53.6	Silty clay
1-1, 133	1.3	8.1	41.8	50.1	Silty clay
1-2, 140	2.9	8.7	33.5	57.8	Silty clay
1-3, 41	3.4	9.7	39.7	50.6	Silty clay
1-4, 31	4.8	2.6	34.7	62.6	Silty clay
2-1, 66	6.7	5.3	44.8	49.9	Silty clay
2-1, 90	6.9	6.4	35.1	58.5	Silty clay
2-2, 22	7.7	14.2	65.1	20.7	Clayey silt
2-3, 41	9.4	3.7	31.6	64.7	Silty clay
2-4, 91	11.4	8.5	33.4	58.1	Silty clay
2-5, 41	12.4	13.2	31.8	55.0	Silty clay
3-1, 41	15.4	4.3	30.3	65.4	Silty clay
3-2, 41	16.9	1.0	21.6	77.4	Clay
3-3, 41	18.4	22.7	25.9	51.3	Sand-silt-clay
3-4, 41	19.9	20.2	34.5	45.2	Sand-silt-clay
4-2, 41	25.9	9.2	38.1	52.8	Silty clay
4-3, 41	27.4	0.0	33.4	66.6	Silty clay
4-4, 41	28.9	8.8	37.6	53.6	Silty clay
5-1, 41	33.4	9.3	32.9	57.8	Silty clay
6-1, 41	42.4	3.2	34.5	62.3	Silty clay
7-2, 41	52.9	3.1	27.1	69.7	Silty clay
8-2, 41	61.9	4.1	26.8	69.1	Silty clay
9-1, 41	69.4	2.3	26.9	70.8	Silty clay
10-1, 41	78.4	1.9	28.6	69.5	Silty clay
11-1, 41	82.4	3.9	31.9	64.3	Silty clay
12-2, 41	92.9	2.1	22.9	75.0	Clay
13-1, 41	119.4	23.5	43.0	33.5	Sand-silt-clay
14-1, 118	129.2	31.5	49.2	19.3	Sandy silt
15-1, 40	156.4	17.1	53.6	29.3	Clayey silt
16-1, 60	165.6	6.9	57.9	35.3	Clayey silt
17-2, 70	176.2	0.9	54.4	44.7	Clayey silt
18-1, 20	183.2	5.7	53.6	40.7	Clayey silt
19-1, 30	192.3	11.5	49.4	39.1	Clayey silt
20-2, 41	202.9	6.5	45.3	48.2	Silty clay
21-2, 41	211.9	8.7	48.8	42.4	Clayey silt
Hole 219A					
14-3, 63	405.6	22.3	32.7	44.9	Sand-silt-clay
Site 220					
1-1, 74	0.7	3.3	27.3	69.4	Silty clay
1-2, 41	1.9	5.3	38.6	56.1	Silty clay
1-3, 41	3.4	2.6	24.6	72.7	Silty clay
2-1, 41	9.4	1.9	18.1	80.0	Clay
4-1, 83	27.8	0.4	19.6	80.0	Clay
5-2, 41	37.9	0.2	17.9	81.9	Clay
6-1, 41	93.4	2.4	36.0	61.6	Silty clay
7-1, 41	102.4	0.6	45.3	54.2	Silty clay
8-3, 41	114.4	15.6	40.8	43.6	Silty clay
9-2, 41	151.9	0.3	30.0	69.7	Silty clay
10-2, 41	160.9	0.3	47.7	51.9	Silty clay
11-1, 42	198.4	3.8	47.5	48.7	Silty clay
12-2, 41	233.9	10.5	45.4	44.1	Clayey silt
13-1, 85	241.9	14.7	43.7	41.6	Clayey silt
14-1, 80	250.8	6.1	47.9	46.0	Clayey silt
15-2, 131	261.8	10.8	44.5	44.7	Silty clay
17-1, 71	297.7	7.9	46.4	45.7	Clayey silt
Site 221					
8-2, 51	84.0	0.3	61.9	37.8	Clayey silt
8-2, 66	84.2	1.6	66.9	31.5	Clayey silt
8-2, 82	84.3	9.3	70.1	20.6	Clayey silt

Core, Section, Top of Interval (cm)	Subbottom Depth (m)	Sand (%)	Silt (%)	Clay (%)	Classification
Site 221 – *Continued*					
10-5, 120	107.2	0.0	36.7	63.3	Silty clay
10-6, 1	107.5	0.0	65.6	34.4	Clayey silt
10-6, 6	107.6	0.0	66.5	33.5	Clayey silt
12-2, 19	119.7	0.0	19.2	80.8	Clay
12-2, 44	119.9	0.1	54.3	45.6	Clayey silt
12-2, 60	120.1	19.1	68.8	12.1	Sandy silt
16-1, 135	168.4	0.8	5.0	94.1	Clay
17-2, 52	217.0	0.2	32.8	67.0	Silty clay
18-1, 12	252.1	0.2	60.7	39.2	Clayey silt
Site 222					
1-1, 43	0.4	2.0	36.9	61.1	Silty clay
2-1, 51	53.5	0.9	39.6	59.6	Silty clay
3-2, 41	102.9	0.8	36.3	62.9	Silty clay
4-1, 71	119.7	0.0	31.5	68.4	Silty clay
5-2, 41	129.9	0.0	36.3	63.7	Silty clay
6-3, 41	140.4	0.1	38.6	61.3	Silty clay
6-4, 116	142.7	0.0	45.6	54.4	Silty clay
6-4, 120	142.7	0.0	59.6	40.4	Clayey silt
6-4, 127	142.8	0.3	90.7	9.1	Silt
6-4, 136	142.9	2.1	95.4	2.5	Silt
7-2, 41	147.9	0.1	47.3	52.6	Silty clay
8-2, 41	185.9	0.3	32.7	67.1	Silty clay
8-4, 67	189.2	0.0	78.0	22.0	Silt
8-4, 75	189.3	0.1	91.1	8.8	Silt
8-4, 82	189.3	0.1	89.8	10.1	Silt
9-2, 41	214.9	41.0	41.0	18.0	Silty sand
11-2, 41	308.9	0.0	39.9	60.1	Silty clay
12-1, 95	354.0	0.0	45.1	54.9	Silty clay
12-2, 96	355.5	0.1	38.9	61.0	Silty clay
13-2, 41	400.9	0.0	36.5	63.5	Silty clay
13-2, 76	401.3	0.0	36.0	64.0	Silty clay
13-3, 100	403.0	0.0	37.1	62.9	Silty clay
13-4, 40	403.9	0.0	31.0	69.0	Silty clay
14-2, 41	409.9	0.0	68.0	32.0	Clayey silt
15-2, 42	428.9	0.0	45.5	54.5	Silty clay
16-1, 41	445.4	0.1	37.0	62.9	Silty clay
18-2, 41	493.9	0.0	26.9	73.1	Silty clay
19-2, 41	541.9	0.2	23.1	76.7	Clay
20-2, 130	589.8	0.2	29.7	70.1	Silty clay
20-3, 60	590.6	0.4	37.5	62.1	Silty clay
21-2, 50	690.5	0.0	36.3	63.7	Silty clay
22-5, 91	696.9	0.5	23.6	75.8	Clay
23-2, 41	748.9	0.3	29.2	70.4	Silty clay
23-4, 124	752.7	0.0	49.2	50.8	Silty clay
24-2, 41	805.9	0.0	35.0	64.9	Silty clay
25-1, 50	861.5	12.7	62.8	24.5	Clayey silt
27-2, 41	926.9	0.0	26.4	73.6	Silty clay
28-2, 41	983.9	0.0	54.1	45.8	Clayey silt
29-2, 41	1042.9	0.0	24.5	75.5	Clay
31-1, 40	1126.4	0.0	37.7	62.3	Silty clay
32-2, 41	1161.9	0.2	37.9	61.9	Silty clay
32-4, 128	1165.8	0.0	37.5	62.5	Silty clay

Core, Section, Top of Interval (cm)	Subbottom Depth (m)	Sand (%)	Silt (%)	Clay (%)	Classification
Site 222 – *Continued*					
33-2, 31	1212.8	0.0	31.3	68.7	Silty clay
35-1, 85	1286.8	0.1	48.7	51.2	Silty clay
36-2, 55	1297.1	0.0	41.8	58.2	Silty clay
Site 223					
1-2, 41	1.9	4.1	47.8	48.1	Silty clay
2-2, 41	29.9	1.9	45.1	53.0	Silty clay
2-2, 91	30.4	18.7	73.1	8.2	Sandy silt
2-2, 128	30.8	51.9	40.0	8.1	Silty sand
2-3, 6	31.1	53.6	37.8	8.6	Silty sand
2-3, 34	31.3	54.0	33.9	12.1	Silty sand
2-3, 45	31.5	1.3	50.6	48.2	Clayey silt
4-2, 41	142.9	1.0	63.1	36.0	Clayey silt
5-2, 41	151.9	1.0	55.1	44.0	Clayey silt
6-2, 41	169.9	1.1	59.8	39.1	Clayey silt
7-2, 41	225.9	1.0	25.6	73.4	Silty clay
9-2, 73	273.2	1.0	47.8	51.3	Silty clay
10-2, 100	292.5	1.4	47.5	51.1	Silty clay
11-1, 41	309.4	0.8	51.3	47.9	Clayey silt
12-2, 41	329.9	1.0	41.4	57.6	Silty clay
13-2, 40	348.9	0.7	53.9	45.3	Clayey silt
14-2, 41	367.9	0.8	43.7	55.5	Silty clay
15-2, 41	376.9	0.9	52.2	46.9	Clayey silt
16-2, 42	385.9	0.9	32.1	67.0	Silty clay
17-2, 43	394.9	0.2	52.0	47.8	Clayey silt
18-2, 41	403.9	0.3	29.7	70.0	Silty clay
19-2, 23	412.7	0.8	46.6	52.6	Silty clay
19-2, 41	412.9	0.2	47.0	52.8	Silty clay
19-2, 58	413.1	0.6	53.1	46.4	Clayey silt
19-2, 98	413.5	1.7	84.7	13.6	Silt
19-2, 145	414.0	27.2	55.9	16.8	Sandy silt
20-2, 41	421.9	0.4	50.5	49.1	Clayey silt
21-1, 62	429.6	0.1	30.2	69.7	Silty clay
22-2, 41	439.9	0.1	26.9	73.0	Silty clay
23-2, 41	452.9	0.4	35.2	64.5	Silty clay
24-1, 41	460.4	0.3	26.7	73.0	Silty clay
25-2, 41	470.9	0.9	34.9	64.2	Silty clay
26-2, 41	479.9	0.3	48.1	51.6	Silty clay
27-2, 41	488.9	0.8	22.9	76.3	Clay
28-1, 70	496.7	7.1	48.2	44.8	Clayey silt
29-1, 79	515.8	6.9	49.9	43.2	Clayey silt
30-1, 61	524.6	0.2	41.9	58.0	Silty clay
31-1, 20	544.2	13.6	34.3	52.1	Silty clay
32-2, 41	564.9	7.8	30.2	62.0	Silty clay
33-2, 41	582.9	7.2	16.1	81.7	Clay
34-2, 96	592.5	0.7	12.0	87.3	Clay
35-2, 40	610.9	1.8	33.3	64.9	Silty clay
Site 224					
2-2, 37	95.9	0.3	35.1	64.6	Silty clay
4-1, 64	259.6	0.4	17.4	82.2	Clay
5-2, 75	352.3	0.0	72.1	27.9	Clayey silt
6-1, 9	453.1	0.0	25.3	74.7	Silty clay
6-4, 42	457.9	0.1	18.1	81.8	Clay
7-1, 48	571.5	0.0	37.1	62.9	Silty clay
8-1, 70	632.7	0.0	76.5	23.4	Silt
8-5, 13	638.1	0.0	58.6	41.4	Clayey silt
8-5, 18	638.2	6.1	67.8	26.0	Clayey silt
8-5, 26	638.3	9.3	68.8	21.8	Clayey silt
8-5, 32	638.3	0.1	50.4	49.5	Clayey silt
8-5, 41	638.4	3.1	72.1	24.8	Clayey silt
8-5, 45	638.5	4.3	70.0	25.7	Clayey silt
8-5, 52	638.5	8.4	71.6	20.1	Clayey silt

Core, Section, Top of Interval (cm)	Subbottom Depth (m)	Sand (%)	Silt (%)	Clay (%)	Classification
Site 224 – *Continued*					
10-2, 71	756.2	0.2	5.6	94.2	Clay
11-1, 30	783.3	11.2	39.6	49.2	Silty clay
11-1, 80	783.8	0.6	30.6	68.8	Silty clay
Site 225					
1-2, 41	1.9	0.9	58.4	40.7	Clayey silt
3-2, 115	20.6	4.8	45.0	50.3	Silty clay
4-1, 120	25.7	4.9	45.1	50.1	Silty clay
5-2, 50	29.0	3.2	36.7	60.1	Silty clay
12-1, 110	78.1	30.3	35.2	34.5	Sand-silt-clay
13-5, 25	83.3	10.7	42.9	46.3	Silty clay
13-6, 28	84.8	13.5	47.7	38.8	Clayey silt
14-2, 45	88.0	2.0	48.7	49.3	Silty clay
15-2, 122	97.7	0.3	58.1	41.6	Clayey silt
17-2, 56	115.1	0.3	52.6	47.1	Clayey silt
18-1, 78	122.8	0.4	41.1	58.5	Silty clay
Site 227					
13-1, 25	90.3	1.9	34.5	63.6	Silty clay
16-1, 105	114.1	2.7	59.9	37.5	Clayey silt
16-2, 22	114.7	2.9	34.5	62.6	Silty clay
18-2, 120	133.7	0.4	42.8	56.9	Silty clay
19-2, 14	141.6	1.1	48.3	50.6	Silty clay
20-2, 78	151.3	0.8	33.0	66.2	Silty clay
20-3, 140	153.4	1.8	47.7	50.5	Silty clay
20-5, 35	155.4	0.0	37.4	62.6	Silty clay
22-4, 68	163.2	1.4	54.9	43.8	Clayey silt
24-6, 49	184.0	0.1	40.6	59.2	Silty clay
25-2, 39	186.9	6.6	42.9	50.6	Silty clay
28-2, 47	214.0	0.0	95.7	4.2	Silt
Site 228					
4-5, 21	30.2	9.1	50.3	40.6	Clayey silt
4-5, 39	30.4	16.2	58.0	25.8	Clayey silt
4-5, 49	30.5	13.6	62.4	24.0	Clayey silt
6-5, 83	48.8	4.5	73.2	22.2	Clayey silt
6-5, 115	49.2	3.2	71.2	25.6	Clayey silt
6-5, 125	49.3	3.3	71.7	25.0	Clayey silt
7-6, 64	59.1	6.3	58.6	35.1	Clayey silt
7-6, 78	59.3	10.2	67.4	22.4	Clayey silt
16-1, 124	124.2	0.5	51.4	48.1	Clayey silt
18-1, 145	142.4	6.2	66.8	27.0	Clayey silt
23-2, 94	184.4	4.5	69.5	26.0	Clayey silt
26-1, 130	210.3	19.0	64.2	16.7	Sandy silt
28-2, 101	229.5	23.0	62.8	14.2	Sandy silt
28-4, 104	232.5	7.4	49.5	43.1	Clayey silt
Hole 229A					
6-5, 85	80.9	27.8	42.4	29.9	Sand-silt-clay
6-5, 114	81.1	38.9	41.4	19.7	Sandy silt
6-5, 120	81.2	27.8	44.2	28.0	Sand-silt-clay

Part 2 – Grain-Size Analysis by D. C. Jipa[a]

Core, Section, Interval (cm)	Grain-Size Fractions (%) Sand	Silt	Clay	Md_ϕ[b]	Mz_ϕ[b]	$\sigma_{i\phi}$[b]	Sk_i[b]	K_G[b]	C(1%)[c] ϕ
Site 221									
5-3, 128-129	4.7	24.9	70.4	9.5	9.5	2.6	0.0	0.9	1.7
5-3, 133-134	0.1	35.4	64.5	8.3	8.4	1.4	0.0	1.1	5.2
5-3, 137-138	0.2	30.2	69.6	8.8	8.6	1.6	0.1	1.0	4.9
5-3, 147-148	0.4	49.7	49.9	8.0	7.9	1.6	0.0	1.0	4.4
5-4, 18-20	0.2	55.8	44.9	7.4	8.0	1.6	0.6	0.3	4.5
5-4, 35-37	0.0	56.9	43.1	7.6	7.3	1.6	0.1	0.8	4.4
5-4, 42-44	0.5	91.1	8.3	5.7	6.0	1.4	0.4	0.7	4.1
8-2, 32-33	0.0	21.3	78.7	9.6	9.7	1.7	0.1	0.8	5.2
8-2, 47-48	0.1	34.6	65.3	8.8	9.4	2.3	0.5	0.9	5.7
8-2, 56-57	1.0	66.5	32.6	7.3	7.9	2.0	0.4	1.7	4.0
8-2, 61-62	0.2	56.4	43.4	7.9	8.6	1.9	0.6	1.2	5.0
8-2, 64-65	1.5	70.1	28.4	7.0	7.6	2.4	0.4	1.3	3.4
8-2, 73-74	3.7	69.7	26.6	6.7	7.2	2.3	0.4	1.4	3.2
8-2, 84-85	9.1	72.0	18.9	5.8	6.2	2.5	0.4	1.2	2.6
10-5, 90-91	0.2	44.8	55.1	8.2	8.1	1.5	−0.5	0.9	5.7
10-5, 102-103	0.0	54.2	45.8	7.2	7.6	1.7	0.3	0.8	4.8
10-5, 139-140	0.1	82.3	17.6	7.1	7.1	1.6	0.2	2.2	4.7
10-5, 149-150	0.0	70.1	29.9	6.4	7.4	2.5	0.6	1.1	4.5
12-2, 3-4	0.2	39.8	60.0	8.6	8.9	2.1	0.2	0.9	4.9
12-2, 17-18	0.0	30.5	69.5	9.0	9.0	1.6	0.0	0.9	5.2
12-2, 32.5-33.5	0.2	17.2	82.6	9.4	9.5	1.6	0.1	0.9	5.2
12-2, 43-43	0.3	48.8	50.9	8.1	8.2	1.4	0.1	0.7	4.4
12-2, 51-52	0.2	69.4	30.4	7.0	7.7	2.0	0.6	1.2	4.7
12-2, 58-59	23.4	65.4	11.2	4.4	5.0	1.8	0.6	1.9	2.3
Site 222									
Coarser Grained Intercalations									
9-3, 81-83	0.0	43.3	56.7	8.3	8.6	2.1	0.1	0.9	5.2
9-3, 94-96	0.5	68.0	31.5	6.9	7.6	2.1	0.5	1.1	4.3
9-3, 113-115	0.3	77.6	22.4	6.4	7.0	1.9	0.6	1.4	4.4
9-3, 135-137	0.1	88.3	11.6	5.8	6.1	1.4	0.7	1.9	4.4
9-4, 5-7	0.6	86.5	12.9	5.6	6.1	1.4	0.6	0.9	4.2
9-4, 32.5-34.5	0.9	91.5	7.6	5.2	5.4	1.2	0.5	1.7	4.0
28-5, 74-75.5	22.9	63.8	13.3	5.3	5.5	2.0	0.2	1.2	2.2
28-5, 84-86	26.6	63.2	10.2	5.0	5.1	1.9	0.1	1.2	2.0
28-5, 93-94.5	26.6	63.2	10.2	5.1	5.2	2.0	0.2	1.2	2.0
Fine-grained Sediments									
1-4, 85-87	3.3	48.2	48.5	7.9	8.0	2.6	0.1	0.9	3.1
2-4, 143-145	2.3	56.9	40.8	7.1	7.7	2.9	0.3	0.9	3.5
3-2, 54-56	1.4	33.3	59.3	8.6	8.1	2.3	−0.1	1.2	3.8
4-1, 90-92	0.1	40.0	59.9	8.7	8.9	2.3	0.2	0.9	4.5
5-3, 60-62	0.1	41.9	57.9	8.5	8.9	2.5	0.3	0.9	5.4
5-5, 60-62	0.3	40.7	59.0	8.8	8.5	1.6	−0.2	0.8	5.2
6-2, 50-52	0.0	42.1	57.9	8.6	9.1	2.6	0.3	0.9	5.0
12-2, 33-35	0.0	41.4	58.6	8.5	8.9	2.3	0.1	0.9	4.6
13-3, 44-46	0.0	45.4	54.6	8.3	8.8	2.6	0.3	0.9	4.9
22-2, 22-24	0.2	46.8	53.0	8.7	8.9	2.2	0.1	0.9	4.8

[a]Geological Institute, Bucharest, Romania

[b]Md, M_Z, σ_i, SK_i, K_G according to Folk and Ward (1957) formulas.

[c]C(1%) according to Passega (1964).