

14. CARBON AND CARBONATE ANALYSES, LEG 16

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The amounts of acid-soluble and acid-insoluble carbon in sediment samples of Leg 16 have been determined in the laboratory of the Deep Sea Drilling Project by Techniques described in detail in Bader, Gerard et al. (1970) and Boyce and Bode (1972). The data are listed in Table 1 and graphically displayed in Chapters 2 through 10 of this volume. In addition, analyses for calcium carbonate were made by a gravimetric method for samples used in connection with the study of the basal iron-rich sediments (Chapter 18, this volume); the method is described in the last section, and the results have been listed in Table 2.

TABLE 1
Carbon-Carbonate Analyses, Leg 16
 Except as Noted in Key, Analyses Are By
 LECO 70 Second Analyzer

Core, Section	Top of Interval (cm)	Depth in Hole (m)	Carbon Total (%)	Organic Carbon (%)	CaCO ₃ (%)
DSDP 156					
1-1(139.0)	1.4	9.4	0.3	76	
DSDP 157					
1-1(100.0)	11.0	3.3	0.3	26	
1-2(80)	12.3	9.6	0.4	77	
1-5(80.0)	16.8	9.5	0.2	78	
2-1(60.0)	19.6	9.3	0.4	74	
2-2(60.0)	21.1	9.4	0.4	75	
2-3(60.0)	22.6	9.6	0.2	79	
2-4(60.0)	24.1	9.6	0.2	78	
2-6(60.0)	27.1	9.0	0.3	72	
3-1(60.0)	28.6	8.3	0.5	65	
3-2(60.0)	30.1	8.8	0.4	70	
3-3(60.0)	31.6	8.4	0.4	67	
3-4(60.0)	33.1	9.2	0.3	74	
3-5(60.0)	34.6	8.4	0.3	67	
3-6(60.0)	36.1	8.0	0.3	64	
4-1(60.0)	37.6	10.1	0.2	83	
4-1(60.0)	37.6	8.9	0.3	72	
4-2(60.0)	39.1	8.6	0.3	69	
4-3(60.0)	40.6	7.9	0.3	63	
4-4(60.0)	42.1	7.9	0.3	63	
4-5(60.0)	43.6	8.0	0.3	64	
4-6(60.0)	45.1	7.7	0.3	62	
5-1(60.0)	46.6	9.2	0.0	77	
5-2(60.0)	48.1	9.0	0.4	72	
5-3(60.0)	49.6	9.5	0.2	77	
5-4(60.0)	51.1	9.5	0.2	77	
5-5(60.0)	52.6	9.2	0.3	74	
5-6(60.0)	54.1	9.0	0.3	73	
6-1(60.0)	55.6	7.3	0.4	58	
6-2(60.0)	57.1	7.2	0.4	56	

TABLE 1 – Continued

Core, Section	Top of Interval (cm)	Depth in Hole (m)	Carbon Total (%)	Organic Carbon (%)	CaCO ₃ (%)
6-3(60.0)	58.6	7.7	0.3	61	
6-4(60.0)	60.1	8.8	0.6	68	
6-5(60.0)	61.6	7.5	0.5	59	
6-6(60.0)	63.1	8.1	0.4	64	
7-1(100.0)	65.0	8.5	0.4	68	
7-2(60.0)	66.1	8.6	0.3	69	
7-3(60.0)	67.6	9.0	0.2	73	
7-4(60.0)	69.1	8.8	0.2	71	
7-5(60.0)	70.6	8.3	0.3	67	
8-1(60.0)	73.6	8.9	0.2	72	
8-2(60.0)	75.1	8.6	0.3	69	
8-3(60.0)	76.6	8.2	0.3	66	
8-4(60.0)	78.1	8.2	0.3	66	
9-1(120.0)	83.2	8.5	1.1	62	
9-2(60.0)	84.1	7.4	2.0	44	
9-3(60.0)	85.6	8.1	1.2	57	
9-4(60.0)	87.1	6.8	1.4	45	
9-5(60.0)	88.6	7.1	1.5	47	
9-6(60.0)	90.1	6.7	1.3	45	
10-1(60.0)	91.6	6.9	1.1	48	
10-2(60.0)	93.1	7.4	1.6	48	
10-3(60.0)	94.6	7.1	1.6	46	
10-4(60.0)	96.1	7.4	1.3	50	
11-1(70.0)	99.7	8.3	0.4	65	
11-2(60.0)	101.1	8.6	0.6	67	
11-3(30.0)	102.3	9.0	0.6	70	
11-4(60.0)	104.1	8.8	0.6	68	
13-1(60.0)	117.6	9.0	0.3	72	
13-2(60.0)	119.1	9.2	0.3	74	
13-3(10.0)	120.1	9.3	0.3	75	
13-4(60.0)	122.1	7.6	0.8	56	
13-6(60.0)	125.1	8.4	0.7	64	
14-1(100.0)	127.0	8.4	0.4	66	
14-2(60.0)	128.1	7.0	0.9	50	
14-3(60.0)	129.6	5.9	0.9	42	
14-4(60.0)	131.1	7.6	0.5	59	
14-5(60.0)	132.6	6.7	0.3	53	
14-6(60.0)	134.1	8.0	0.5	63	
15-1(60.0)	135.6	7.2	0.6	55	
15-2(60.0)	137.1	7.6	0.5	59	
15-3(60.0)	138.6	8.4	0.3	68	
15-3(60.0)	138.6	7.8	0.3	62	
15-4(60.0)	140.1	8.4	0.3	67	
15-5(60.0)	141.6	8.4	0.3	67	
15-6(60.0)	143.1	7.9	0.3	63	
16-1(60.0)	144.6	7.5	0.3	60	
16-2(60.0)	146.1	8.0	0.3	65	
16-3(60.0)	147.6	7.8	0.3	62	
16-4(60.0)	149.1	8.0	0.3	64	
16-5(60.0)	150.6	7.7	0.2	62	
16-6(60.0)	152.1	6.8	0.2	55	

TABLE 1—Continued

Core, Section	Top of Interval (cm)	Depth in Hole (m)	Carbon Total (%)	Organic Carbon (%)	CaCO ₃ (%)
	11-1(112.0)	210.1	2.7	0.0	23
	11-2(13.0)	210.6	2.4	0.0	20
	11-3(60.0)	212.6	1.3	0.0	11
	11-4(60.0)	214.1	2.6	0.0	21
	11-5(60.0)	215.6	2.2	0.0	18
DSDP 162	12-1(74.0)	218.7	0.8	0.0	7
	13-1(93.0)	227.9	3.9	0.0	32
	14-1(85.0)	235.9	6.5	0.1	54
	14-2(69.0)	237.2	4.2	0.0	35
	1-1(40.0)	0.4	10.2	0.0	85
	1-2(40.0)	1.9	7.5	0.0	62
	1-3(40.0)	3.4	8.9	0.0	74
	1-4(53.0)	5.0	8.9	0.0	74
	1-4(60.0)	5.1	10.5	0.0	87
	1-5(55.0)	6.6	10.0	0.0	83
	1-6(60.0)	8.1	5.4	0.0	45
	2-1(60.0)	9.6	9.1	0.0	76
	2-2(60.0)	11.1	9.5	0.0	79
	2-3(60.0)	12.6	10.4	0.0	87
	2-3(60.0)	12.6	9.4	0.0	78
	2-5(60.0)	15.6	9.2	0.3	74
	2-6(60.0)	17.1	9.5	0.0	79
	3-1(60.0)	18.6	8.5	0.2	69
	3-2(60.0)	20.1	6.7	0.2	54
	3-3(50.0)	21.5	6.9	0.2	56
	3-4(60.0)	23.1	7.5	0.9	55
	3-5(60.0)	24.6	8.2	0.0	68
	3-6(60.0)	26.1	5.0	0.0	42
	4-1(60.0)	27.6	9.1	0.0	75
	4-2(60.0)	29.1	0.4	0.0	3
	4-3(60.0)	30.6	1.6	0.0	13
	4-4(60.0)	32.1	0.2	0.0	2
	4-5(30.0)	33.3	1.2	0.0	10
	4-6(7.0)	34.6	0.1	0.0	1
	5-1(90.0)	36.9	0.2	0.0	2
	5-2(60.0)	38.1	1.5	0.0	13
	5-3(60.0)	39.6	1.3	0.0	11
	5-4(60.0)	41.1	0.0	0.0	0
	5-5(60.0)	42.6	0.5	0.0	4
	5-6(60.0)	44.1	0.7	0.0	5
	6-1(60.0)	45.6	0.0	0.0	0
	6-2(6.0)	46.6	0.1	0.0	1
	6-3(60.0)	48.6	0.2	0.0	1
	6-4(50.0)	50.0	0.0	0.0	0
	7-1(30.0)	54.3	0.1	0.0	1
	7-2(60.0)	56.1	0.1	0.0	1
	7-3(60.0)	57.6	0.1	0.0	1
	7-4(60.0)	59.1	0.0	0.0	0
	7-5(60.0)	60.6	0.0	0.0	0
	7-6(30.0)	61.8	0.0	0.0	0
	8-1(60.0)	63.6	5.9	0.0	49
	8-2(60.0)	65.1	6.6	0.1	54
	8-3(60.0)	66.6	6.0	0.0	49
	8-4(60.0)	68.1	7.3	0.0	61
	8-5(60.0)	69.6	6.6	0.0	55
	8-6(60.0)	71.1	5.3	0.0	43
	9-1(60.0)	72.6	6.5	0.0	54
	9-2(60.0)	74.1	6.8	0.0	57
	9-3(60.0)	75.6	4.8	0.1	39

TABLE 1—Continued

Core, Section	Top of Interval (cm)	Depth in Hole (m)	Carbon Total (%)	Organic Carbon (%)	CaCO ₃ (%)
	9-4(60.0)	77.1	6.4	0.0	53
	9-5(60.0)	78.6	1.0	0.0	8
	9-6(60.0)	80.1	2.0	0.1	16
DSDP 163	10-2(60.0)	83.1	2.1	0.1	17
	10-3(10.0)	84.1	0.3	0.0	2
	10-4(20.0)	86.1	2.9	0.0	24
	10-5(20.0)	87.2	2.3	0.0	19
	10-6(60.0)	89.1	2.5	0.0	20
	11-1(126.0)	91.3	1.1	0.0	9
	11-2(60.0)	92.1	2.6	0.1	21
	11-3(52.0)	93.5	2.7	0.0	22
	11-4(60.0)	95.1	3.1	0.5	22
	11-5(60.0)	96.6	1.8	0.1	15
	11-6(60.0)	98.1	3.0	0.3	22
	12-1(60.0)	99.6	0.9	0.0	7
	12-2(60.0)	101.1	1.0	0.0	8
	12-4(60.0)	104.1	0.3	0.0	3
	12-3(60.0)	102.6	1.1	0.0	9
	12-5(60.0)	105.6	1.3	0.0	11
	12-6(60.0)	107.1	3.1	0.0	25
	13-1(60.0)	108.6	3.0	0.0	25
	13-2(60.0)	110.1	5.5	0.0	45
	13-3(60.0)	111.6	4.7	0.0	39
	13-4(60.0)	113.1	2.8	0.0	23
	13-5(60.0)	114.6	5.1	0.0	42
	13-6(60.0)	116.1	0.7	0.0	6
	14-1(60.0)	117.6	2.1	0.1	17
	14-2(60.0)	119.1	1.3	0.0	10
	14-3(60.0)	120.6	2.4	0.0	19
	14-4(60.0)	122.1	4.4	0.1	36
	14-5(60.0)	123.6	1.6	0.0	13
	14-6(60.0)	125.1	3.5	0.0	29
	15-1(60.0)	126.6	3.8	0.0	31
	15-2(60.0)	128.1	2.3	0.0	19
	15-3(10.0)	129.1	2.9	0.0	24
	15-4(60.0)	131.1	4.1	0.0	34
	15-5(60.0)	132.6	4.2	0.0	34
	15-6(60.0)	134.1	4.4	0.0	36
	16-1(70.0)	135.7	2.2	0.1	18
	16-2(60.0)	137.1	0.0	0.0	0
	16-3(42.0)	138.4	0.0	0.1	0
	17-1(22.0)	144.2	0.0	0.1	0
	17-2(60.0)	146.1	8.6	0.1	71
	17-3(14.0)	147.1	6.2	0.1	51
	17-4(107.0)	149.6	9.5	0.1	79

DSDP CARBON DETERMINATIONS

Each sample was ground to a homogeneous fine powder, dried 24 hours at 105-110°C, divided into two parts, and weighed. The first part was analyzed for its total carbon content, and the second part was acidified with hydrochloric acid and then analyzed for residual carbon which is labeled in the table as "organic" carbon. The carbon contents are reported in per cent by weight. The percentages of calcium carbonate in the sample are calculated as follows: (% total C - % C after acidification) $\times 8.33 =$ per cent calcium carbonate (CaCO_3). Evidently, the sediments may contain magnesium carbonate, iron carbonate, and perhaps other carbonates as well. In those cases, the percentage carbonate listed refer to more than calcium carbonate alone.

The carbonate determinations were made with a LECO (Laboratory Equipment Corporation) carbon analyzer. A detailed description of the technique can be found in the references given in the introduction. The standard equipment used is the LECO 70 Second Carbon Analyzer; precisions are as follows:

Total Carbon

- (1.2 to 12%): $\pm 0.2\%$ (absolute variation)
- (0 to 1.2%): $\pm 0.04\%$ (absolute variation)
- Organic Carbon $\pm 0.04\%$ (absolute variation)
- Calcium Carbonate

- (10 to 100%): $\pm 2.0\%$ (absolute variation)
- (0 to 10%): $\pm 0.6\%$ (absolute variation)

With a single operator and over a short period of time, the standard deviation for calcium carbonate between 10 and 100 per cent is ± 0.2 per cent. Over a longer period of time and with more than one operator, the standard deviation is about ± 0.6 per cent. For data between 0 and 10 per cent, the standard deviation is about ± 0.15 per cent.

Due to mechanical and electronic difficulties, the LECO 70 Second Analyzer was inoperative during part of the analysis program, and a second method, the LECO Acid-Base Semi-Automatic Carbon Determinator, was substituted. The procedure is described in Boyce and Bode (1972). In general, this technique compares well in precision and accuracy with the LECO 70 Second Analyzer, but it is possible that a slight degradation of the data may have resulted in the present case.

A key to the different analysis methods used precedes Table 1.

GRAVIMETRIC ANALYSES

For a number of samples that were studied in connection with the report on iron-rich basal sediments (Chapter 18, this volume), analyses of calcium carbonate were made in the laboratory of D.S. Cronan, using a gravimetric technique. Each sample was finely ground and heated to 105°C to remove moisture. Approximately 0.25-0.50 gm of material was weighed into a 150 ml Erlenmeyer flask. Carbon dioxide was evolved by treatment with H_3PO_4 , bubbled through H_2SO_4 under right vacuum, and absorbed in Ascarite in two weighed U tubes. The results,

calculated as calcium carbonate, are shown in Table 2. This data has not been included in graphic summaries in the site descriptions.

REFERENCES

- Bader, R.G., Gerard, R.D. et al., 1970. Initial Reports of the Deep Sea Drilling Project, Volume IV. Washington (U.S. Government Printing Office). 745.
- Boyce, R.E. and Bode, G.W., 1972. Carbon and carbonate analyses, Leg 9, Deep Sea Drilling Project. In Hays et al., 1972. Initial Reports of the Deep Sea Drilling Project, Volume IX. Washington (U.S. Government Printing Office). 797.

KEY TO CARBON-CARBONATE ANALYSIS METHODS

Organic Carbon Analysis by Acid-Base Method

- 157-22-3(60 cm) through 157-33-2(60 cm).
- 157-33-4(60 cm) through 157-42-1(70 cm).
- 157-A-1-2(30 cm) through 157A-3-4(60 cm).
- 158-1-2(60 cm) through 158-1-3(60 cm).
- 158-6-2(60 cm).
- 158-10-5(60 cm).
- 158-21-4(60 cm).
- 158-24-2(60 cm).
- 158-27-5(60 cm).
- 160-2-1(29 cm).
- 160-2-4(29 cm).
- 160-3-5(29 cm).
- 160-6-5(29 cm).
- 161-1-1(85 cm).

Total Carbon and Organic Carbon By Acid-Base Method

- 157A-3-5(70 cm) through 158-1-1(60 cm).
- 158-2-1(60 cm) through 158-6-1 (60 cm).
- 158-6-3(60 cm) through 158-10-4 (60 cm).
- 158-10-6(60 cm) through 158-15-5(60 cm).
- 158-16-1(60 cm) through 158-19-4(60 cm).
- 158-19-6(60 cm) through 158-21-3(60 cm).
- 158-21-5(60 cm) through 158-23-5(60 cm).
- 158-25-2(64 cm) through 158-27-4(60 cm).
- 158-27-6(60 cm) through 158-9-2(60 cm).
- 158-30-1(60 cm) through 158-32-2(60 cm).
- 158-32-4(60 cm) through 160-1-3(120 cm).
- 160-2-3(29 cm).
- 160-2-5(29 cm) through 160-3-3(29 cm).
- 160-4-1(80 cm) through 160-6-4(29 cm).
- 160-6-6(29 cm) through 161-1-1(50 cm).
- 161-1-2(60 cm) through 161-12-3(60 cm).

Total Carbon By Acid-Base Method

- 158-15-6(60 cm).
- 158-19-5(100 cm).
- 158-29-3(60 cm).
- 158-32-3(60 cm).
- 161-12-4(60 cm) through 161A-1-4(60 cm).
- 161A-1-6(50 cm) through 161A-7-5(60 cm).