Terra Antartica
2000, 7(3), 389-391

TERRA ANTARTICA

Short Note

Carbonate Contents in CRP-2/2A, Victoria Land, Antarctica

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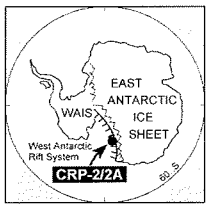
Received 25 August 1999; *accepted in revised form on* 18 November 1999

Introduction



Determinations of total carbonate contents on CRP-2/2A cores yield additional information and knowledge, thus enabling or enhancing the interpretation and characterization of the depositional environment, the sedimentation, and the diagenesis of sediments. In case of drilling profiles, they help to discern vertical gradation of facies sequences with repeating patterns or with changes in time. A total of 74 bulk samples originating from the Quaternary, Miocene and Oligocene strata of the CRP-2 and CRP-2A boreholes, final depth 624.15 metres below sea floor (mbsf). 38 of a total of 41 lithostratigraphic units of the boreholes were sampled (Tab. 1). Two samples (7.11-16,97 mbsf) belong to the Quaternary, 1 sample (23.54 mbsf) belongs to the Pliocene, 12 samples (30.71-123.71 mbsf) to the Miocene, whereas 53 samples (135.24-623.81 mbsf) originate from the Oligocene strata. The sampling intervals vary from 7-9 m for the Quaternary, 5-12 m for the Miocene or 3-12 m for the Oligocene. All the samples originate from sections of the profile of not more than 1-2 cm thickness. The samples were partioned; the partions of the samples were used for investigations with regard to clay minerals (Ehrmann, this vol.), heavy minerals (Polozek, this vol.), and XRD analyses (Neumann & Ehrmann, this vol.).

Methods

The 74 bulk samples were freeze-dried, ground, and homogenized before analysing for carbonates. In order to determine the total carbonate contents, a method was applied which measures the CO_2 set free in the carbonate-acid reaction not volumetrically, like in gasometric standard analyses, but by mesasuring the pressure in the reaction vessel as a function of time, using pressure sensors and a PC-based data aquisition system for the digitized data (Dietrich & Klosa, 1998, Klosa 1994).

Results

A sligthly elevated percentage (> 10% in weight) of carbonates was measured in the CRP-2/2A profile only in one section (unit 15.2), with a peak of 12.9% in weight (Fig. 1). The remainder of the sediments in the profile shows significantly lower carbonate contents. With exception of unit 15.2, the carbonate contents in the

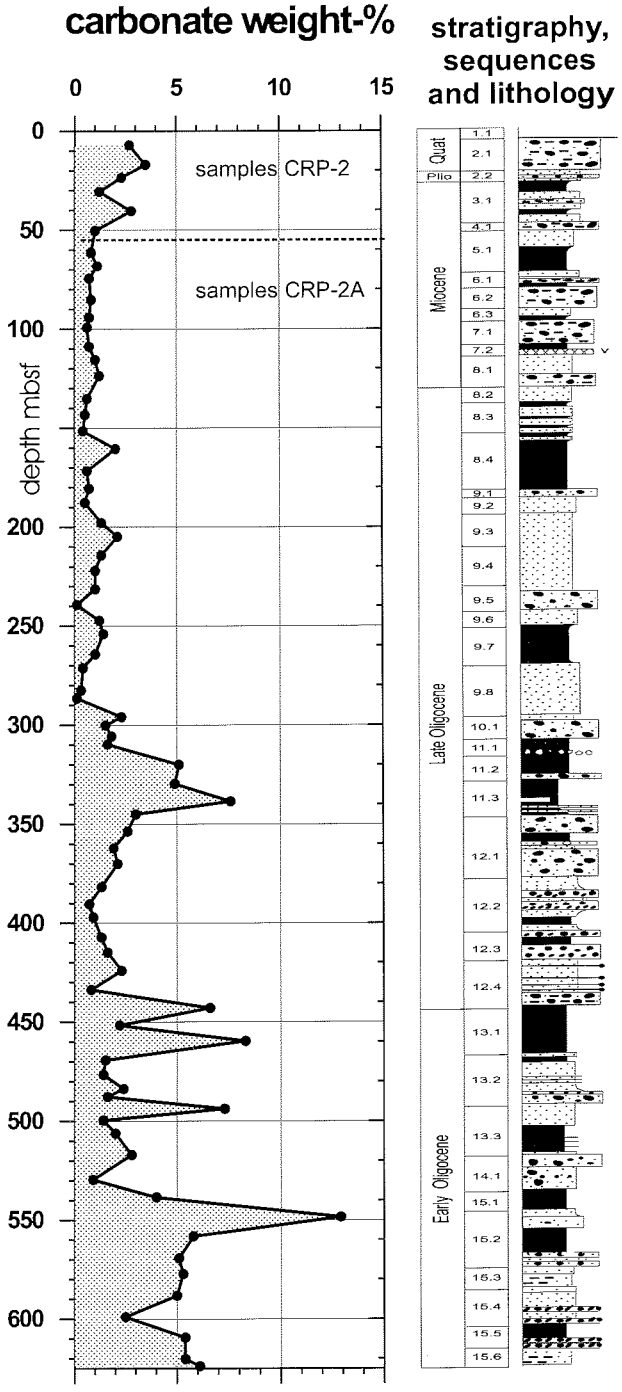


Fig. 1 - Profile of total carbonate in CRP-2/2A bulk samples.

Tab. 1 - Sample intervals and first results of carbonate contents of CRP-2/2A (notes of lithology combined after Cape Roberts Science Team, 1999a, 1999b).

Box 2 / 2A (No.)	Sample Depth (mbsf)	(No.)	Lithostratigraphic Subdivision Unit (No.)	Sediment Type in Sampled Section	Carbonate Content (Wt - %)
1	7.11	1	2.1	Clast-rich sandy diamicton	2.7
4	16.97	2	2.1	Clast-poor muddy diamicton; carbonate cemented clasts (?)	3.5
6	23.54	3	2.2	Clast-rich sandy diamicton	2.3
8	30.71	4	3.1	Muddy fine sand; patches of carbonate cement	1.2
11	40.48	5	3.1	medium sand; carbonate cemented sandstone clast	2.8
14	50.36	6	4.1	Sandy diamicton; local patches of carbonate cement (?)	1.0
9	61.48	7	5.1	Sandy mudstone	0.8
12	68.24	8	5.1	Muddy very fine sand; carbonate cemented (?)	1.1
13	74.5	9	6.1	Muddy sand	0.7
17	85.22	10	6.2	Sandy diamictite with clasts	0.8
20	94.22	11	6.3	Fine to medium Sand	0.7
21	99.22	12	7.1	Sandy diamictite	0.6
25	108.84	13	7.1	Clast-rich sandy diamictite	0.7
27	115.63	14	8.1	Fine sandstone	1.0
30	123.72	15	8.1	Muddy very fine sand	1.2
34	135.24	16	8.2	Fine sandstone	0.6
36	143.39	17	8.3	Very fine sandy mudstone	0.5
39	151.52	18	8.3	Fine sand	0.4
42	160.53	19	8.4	Very fine sandy mudstone; weakly carbonate cemented	2.0
45	171.7	20	8.4	Very fine sandy mudstone	0.6
48	180.72	21	8.4	Very fine sandy mudstone	0.7
51	187.76	22	9.2	medium to fine sandstone	0.5
54	197.93	23	9.3	Muddy fine to medium sandstone; carbonate cement; fossil bearing (?)	1.3
56	204.96	24	9.3	Muddy fine to medium sandstone; locally carbonate cement; fossils (?)	2.1
58	214.3	25	9.4	Muddy fine sandstone; weakly carbonate cemented	1.3
60	222.13	26	9.4	Muddy fine sandstone; carbonate cemented (?); fossil fragments (?)	1.0
62	231.35	27	9.5	Muddy fine sandstone; fossil bearing (?)	1.0
64	239.24	28	9.5	Clast-poor sandy diamictite	0.1
66	247.29	29	9.6	Muddy very fine sandstone; fossil bearing (?)	1.2
68	254.08	30	9.7	Mudstone; locally weakly carbonate cemented	1.4
71	264.35	31	9.8	Muddy fine sandstone;carbonate cemented (?)	1.0
72	271.25	32	9.8	Muddy fine sandstone	0.4
75	282.56	33	9.8	Muddy fine sandstone	0.3
75	286.57	34	9.8	Muddy fine sandstone	0.1
78	295.92	35	10.1	Muddy fine sandstone with dispersed clasts	2.3
79	300.13	36	10.1	Clast-rich sandy diamictite; carbonate cemented (?)	1.5
80	305.67	37	10.1	Muddy fine sandstone; carbonate cemented patches (?)	1.8
81	309.7	38	11.1	Muddy fine to medium sandstone; carbonate cemented patches (?)	1.6
84	319.98	39	11.2	Mudstone; carbonate cemented (?); fossil bearing (?)	5.1
86	329.64	40	11.3	Mudstone; carbonate cemented (?); fossil bearing (?)	4.9
88	338.62	41	11.3	Mudstone; carbonate cemented (?); fossil bearing (?)	7.6
90	345.02	42	11.3	Mudstone; carbonate cemented (?); fossil bearing (?)	3.0
91	353.64	43	12.1	Clast-rich sandy diamictite; weakly carbonate cemented	2.6
94	362.21	44	12.1	Clast-rich sandy diamictite; local carbonate cement (?)	1.9
96	370.12	45	12.1	Clast-poor sandy diamictite; local carbonate cement (?)	2.1
98	381.73	46	12.2	Fine to medium sandstone; local carbonate cement (?)	1.3
100	390.42	47	12.2	Fine sandstone	0.7
102	397.09	48	12.2	Muddy fine sandstone with dispersed granules	0.9
104	407.28	49	12.3	Clast-rich sandy diamictite	1.3
106	414.87	50	12.3	Clast-rich muddy diamictite; fossil bearing (?)	1.6
108	424.13	51	12.4	Fine sandstone; carbonate cemented (?)	2.3
109	433.72	52	12.4	Fine to medium sand	0.8
111	442.96	53	12.4	Clast-poor sandy and muddy diamictite; well carbonate cemented	6.6
113	451.67	54	13.1	Clast-poor muddy fine sandstone; carbonate cemented clasts (?)	2.2
115	459.65	55	13.1	Fine sandy mudstone; strongly carbonate cemented; fossil (?)	8.3
118	469.26	56	13.2	Muddy fine sandstone; fossil bearing (?)	1.5
120	476.6	57	13.2	Muddy fine sandstone; moderately carbonate cemented	1.4
121	483.71	58	13.2	Muddy fine sandstone; locally carbonate cemented; fossil bearing (?)	2.4
123	487.8	59	13.2	Fine sandstone; locally carbonate cemented (?)	1.6
124	493.87	60	13.3	Muddy fine sandstone; dispersed clasts; carbonate cemented nodules (?)	7.3
125	499.63	61	13.3	Fine sandstone; nodular carbonate cement	1.4
127	506.25	62	13.3	Muddy very fine sandstone; carbonate cementation (?)	2.0
130	517.00	63	14.1	Medium sandstone with conglomerate; carbonate cement (some nodular ?)	2.8
133	529.62	64	14.1	Fine to medium sandstone with dispersed clasts; cemented with carbonate (?	0.9
135	538.44	65	15.1	Fine sandy mudstone; calcite veining (?); fossil bearing (?)	4.0
137	548.44	66	15.2	Strongly cemented; medium sandstone showing early nodule formation	12.9
139	558.13	67	15.2	Muddy fine sandstone; carbonate filled microfractures (?)	5.8
141	569.28	68	15.2	Clast-poor sandy diamictite; local patches well carbonate cemented	5.1
144	577.26	69	15.3	Fine sandstone; nodular carbonate cement	5.3
146	588.11	70	15.4	Fine sandstone; with dispered coarse sand; dispersed granules	5.0
149	598.89	71	15.4	Muddy fine sandstone; locally carbonate cemented; fossil fragments (?)	2.5
151	609.32	72	15.5	Muddy fine sandstone; moderately to strongly carbonate cemented	5.4
154	620.18	73	15.6	Very fine sandstone; carbonate cemented (?); fossil bearing (?)	5.4
155	623.81	74	15.6	Very fine sandstone; calcite veining (?)	6.1

Quaternary sediments are in the range from 2.7 to 3.5% in weight, in the Pliocene of 2.3% in weight. These values are somewhat higher than those of the Miocene sediments (0.6-2.8 % in weight) and than those of the Late Oligocene sediments (0.1-2.1% in weight). The values for the Early Oligocene are, exept for four values with less than 1.0% in weight, generally higher (1.3-12.9% in weight) than those of the younger sediments in these strata. The plot of carbonate contents versus depth (Fig. 1) exhibits this trend of a general increase of carbonate content in Early Oligocene with depth. In spite of the rather coarse sampling in some units or subunits and the limited number of determinations especially in the Miocene and Oligocene strata, it can be stated that (Tab. 1):

1 - the carbonate contents of the Quaternary and Pliocene strata which are unconsolidated and uncementad, are probably due to carbonate cemented clasts;
2 - the carbonate contents of the Miocene and Late Oligocene strata are caused by diagenetic processes, and they are linked to local patches of carbonate cement, weakly carbonate cemented horizons and/or fossil fragments, and, especially in the upper part of the Miocene strata, to carbonate cemented sandstone clast;
3 - at depths of more than 319.98 mbsf (gradational zone of Late Oligocene/Early Oligocene?), almost all of the lithological units contain weakly or local carbonat cement mudstones, sandstones, or diamictites.

In addition, several fossils bearing zones have been observed. At depth greater than 442.96 mbsf, they are characterized by well or strongly carbonate cemented lithologies or patches, nodular carbonate cement, calcite veins or carbonate filled microfracture, especially when carbonate contents are higher than 3-4% in weight. It is obvious from table 1 that the carbonate contents of the Early Oligocene in the range of *c.* 2-8% in weight have been determined often in samples of horizons which are either moderately fossiliferous or bear fossils, fossil fragments or debris only in some parts. Correlations of these first results with the results of other detailed studies will be done as soon as the data is complete and will be available. For this purpose, because of the low carbonate contents, the measurements of the calcite and dolomite contents will be repeated. In addition, the results obtained so far will be supplemented by bulk chemical analyses (XRF) and selective dissolution of the carbonates in the sediment combined with ICP-MS analyses, in order to be able to determine the carbonate components of the samples quantitatively.

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