

GSA DATA REPOSITORY

Data Repository Item #: 9750

Title of article Late Middle Ordovician environmental change and extinction:

Harbinger of the Late Ordovician or continuation of Cambrian patterns?

Author(s) Mark E. Patzkowsky, Leta M. Slupik, Michael A. Arthur, Richard D. Pancost and Katherine H. Freeman

SEE: GSA Bulletin
 X Geology
 GSA Today

v. 25, p. 911 - 914

Contents

.5 pg.

The Geological Society of America
P.O. Box 9140 • Boulder, CO 80301-9140 U.S.A.
Phone 303-447-2020

DATA REPOSITORY

Analytical Methods

Carbonates

Samples were ground to <200 mesh, dried and reacted in 100% phosphoric acid at 90 °C in an automated carbonate preparation device ported to a Finnigan MAT 252 mass spectrometer. Samples were reacted for 1 hour, with a 1-hour blank in between to avoid possible effects of minor amounts of dolomite. The $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values are reported relative to the PDB standard using analyses of NBS-19 as the intermediate standard. Corrections are made according to Craig (1957) and using an equation derived from a lab standard calibration curve for reactions at 90 °C rather than the theoretical equation included in the Finnigan software.

Organic Matter

Approximately 1 g of ground rock was placed in a culture tube and repeatedly exposed to 10% HCl for 12 hours, after which samples were centrifuged and excess HCl removed. 1 mL of 10% HCl was again added to the sample and if effervescence occurred, the previous steps were repeated; otherwise, the samples were placed in an oven at 60 degrees C. When dry, approximately 0.2 g of the resulting sample was combusted in the presence of ashed CuO at 800 degrees C. The resulting CO₂ was cryogenically purified under vacuum, and $\delta^{13}\text{C}$ determined using the dual inlet configuration of a Finnigan MAT252 mass spectrometer.

Weight percent of total carbon was determined by combusting approximately 10 to 20 mg of powdered sample in a Lindberg CO Tube Furnace at 950 degrees C for 6 minutes and then measuring the yield of CO₂ using a UIC Model 5120 Total Carbon Apparatus connected to a UIC Model 5012 CO₂ Coulometer. Abundance of inorganic carbon was determined by acidifying 10 to 20 mg of powdered sample in a heated reaction vessel with 5 mL of 50% phosphoric acid solution for 6 minutes using an UIC Model 5130 acidification module. The evolved CO₂ was titrated and recorded by the coulometer. Total organic carbon content was calculated by subtracting the amount of inorganic carbon from the amount of total carbon in the sample. Blanks and standards were run throughout the testing procedure to confirm proper operating conditions. A primary standard-grade calcium carbonate was used for the standard.

References

- Craig, H., 1957, Isotopic standards for carbon and oxygen and correction factors for mass-spectrometric analysis of carbon dioxide: *Geochimica et Cosmochimica Acta*, v. 12, 133-149.

Table A. $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values (‰ PDB) and weight percent total organic carbon (TOC) of micrite samples collected at the State College, PA 322 Bypass Section. SP - stratigraphic position in meters.

SP (m)	$\delta^{13}\text{C}$	$\delta^{18}\text{O}$	TOC(wgt %)
0.5	1.04	-5.57	0.26
1.0	0.90	-5.63	0.14
2.0	0.57	-5.81	0.38
3.0	1.17	-5.73	0.58
4.0	1.23	-5.71	0.40
4.2	Deike K-bentonite		
5.0	1.44	-5.71	0.57
6.0	1.52	-5.57	0.49
7.0	1.46	-5.74	0.63
8.1	1.61	-5.74	0.88
9.0	1.30	-5.57	0.99
10.0	1.52	-5.60	0.75
11.0	1.90	-5.87	0.82
11.4	Millbrig K-bentonite		
12.0	1.53	-5.80	0.24
13.0	1.95	-5.66	0.27
14.0	2.04	-5.10	0.09
15.0	1.86	-5.60	0.38
16.0	1.77	-5.54	0.37
17.0	1.69	-5.74	0.39
18.0	1.95	-5.71	0.61
19.0	1.82	-5.87	0.35
20.0	2.29	-5.24	0.53
21.0	1.79	-5.66	0.47
22.5	2.4	-5.68	0.27
23.0	2.12	-5.81	0.51
24.0	2.27	-5.71	0.63
25.0	2.61	-5.74	0.39
26.0	2.74	-5.76	0.46
27.0	2.67	-5.90	0.92
28.0	2.79	-5.84	0.51
29.0	2.95	-6.06	0.05
30.0	2.73	-5.51	0.18
31.0	3.09	-6.07	0.83
32.1	3.17	-5.76	0.30
33.0	3.07	-5.92	0.60
34.1	3.00	-5.95	0.94
35.0	3.26	-5.53	0.50
36.0	2.88	-5.87	0.39
37.0	2.82	-5.77	0.59
38.0	3.21	-5.69	0.10
39.1	3.32	-5.79	0.39
40.0	2.99	-5.84	0.14
41.0	3.26	-5.71	0.28
42.0	2.90	-6.02	0.45
43.0	3.42	-5.90	0.27
44.0	3.22	-5.95	0.37
45.0	2.48	-5.79	0.53

Table A. continued

SP (m)	$\delta^{13}\text{C}$	$\delta^{18}\text{O}$	TOC(wgt. %)
46.0	3.62	-5.47	0.12
46.9	3.27	-5.65	0.31
48.1	3.14	-5.81	0.30
49.1	3.18	-6.00	0.14
50.0	2.76	-5.68	0.47

Table B. $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values (‰ PDB) and weight percent total organic carbon (TOC) of micrite samples and $\delta^{13}\text{C}$ values (‰ PDB) of organic carbon collected at the Reedsville, PA Section. SP - stratigraphic position in meters.

SP(m)	$\delta^{13}\text{C}_{\text{carb}}$	$\delta^{18}\text{O}_{\text{carb}}$	$\delta^{13}\text{C}_{\text{org}}$	TOC(wt%)
-45.00	1.32	-5.27		0.00
-35.00	0.99	-5.10		0.19
-30.00	-0.05	-5.24		0.09
-25.00	0.80	-5.25		0.34
-20.00	1.08	-5.70	-28.8	0.78
-19.1	Deicke K-bentonite			
-18.90	1.30	-5.81	-29.0	0.95
-18.10	1.93	-5.44	-29.4	0.69
-17.10	1.60	-5.66	-28.5	0.64
-16.00	1.41	-5.72	-29.0	0.98
-15.00	1.70	-5.45		0.91
-14.10	1.72	-5.17	-29.1	1.06
-13.80	Millbrig K-Bentonite			
-13.00	1.84	-5.65	-28.4	0.42
-12.00	1.86	-5.26		0.41
-11.00	1.80	-5.66		0.63
-10.50	1.79	-5.75	-29.1	1.38
-8.00	2.27	-5.58	-28.3	0.52
-6.95	2.15	-5.55		0.73
-5.90	2.51	-5.40		0.59
-5.00	2.53	-5.48		0.96
-4.00	2.06	-5.80	-28.0	0.79
-2.00	2.49	-5.53	-28.0	1.22
-1.00	2.42	-5.76		0.48
0.00	2.58	-5.49	-27.9	1.56
1.00	2.54	-5.63	-28.3	0.93
2.00	2.97	-5.14		0.30
3.00	2.66	-5.58		0.55
4.00	2.44	-5.30		0.95
5.00	2.47	-5.79	-27.8	0.92
6.00	3.17	-5.53		0.34
7.00	3.10	-5.80	-28.5	0.52
8.00	2.92	-5.83	-27.9	0.71
8.75	3.12	-5.85		1.01
10.00	2.75	-5.77		0.92
11.00	2.86	-5.83	-28.4	0.81
12.25	3.08	-5.63		0.50
13.00	3.22	-5.66	-27.7	0.34
14.00	3.12	-5.71		0.39
15.00	3.35	-5.85	-28.9	0.34
17.00	2.95	-5.92		0.29
17.90	3.05	-5.76	-28.1	0.27
19.00	2.36	-5.57	-28.9	0.24
20.10	3.23	-5.54		0.07
21.00	3.15	-5.62		0.54
22.00	3.26	-5.82	-28.4	0.26
23.00	3.09	-5.65		1.15

Table B. continued

SP(m)	$\delta^{13}\text{C}_{\text{carb}}$	$\delta^{18}\text{O}_{\text{carb}}$	$\delta^{13}\text{C}_{\text{org}}$	TOC(wt%)
24.00	3.11	-5.66	-28.3	0.66
25.00	3.30	-5.81		0.26
26.00	3.28	-5.69	-28.2	0.48
26.60	3.21	-5.47		0.89
27.40	2.63	-5.73	-28.1	0.27
28.00	3.00	-5.59		0.51
29.10	2.92	-5.62	-28.5	0.75
30.00	3.06	-5.61		0.40
31.00	2.94	-5.61		0.29
32.00	3.38	-4.97	-27.7	0.39
33.00	2.99	-5.51		0.46
34.00	3.27	-5.76	-28.2	0.59
35.00	3.25	-5.68	-28.2	0.97
36.00	3.19	-5.56		0.71
37.00	3.28	-5.82		0.34
38.00	3.06	-5.35		0.40
39.00	3.33	-5.73		0.43
40.00	3.02	-5.25	-28.1	0.20
41.00	3.29	-5.50		0.25
42.00	3.15	-5.40		0.27
43.00	3.33	-5.41		0.07
44.00	3.29	-5.62	-28.0	0.28
45.00	3.25	-5.56	-27.8	0.47
46.00	3.05	-5.19	-30.0	0.36
47.00	3.14	-5.50		0.53
48.00	3.07	-5.59		0.20
49.00	2.66	-5.90		0.30
50.00	2.90	-5.87	-27.6	0.45
55.00	3.15	-5.59	-25.9	0.18
57.70	3.17	-5.51	-26.0	0.20
58.70	2.70	-5.52	-26.3	0.38
62.10	3.12	-5.50	-25.1	0.00
65.10	3.29	-5.57	-25.7	0.38
68.10	3.19	-5.23	-25.5	0.29
71.00	3.08	-5.29	-25.9	0.17
73.00	3.19	-5.18	-25.6	0.29
78.00	3.04	-5.40	-25.1	0.29
83.00	3.05	-5.40	-25.6	0.42
88.00	3.21	-5.50	-26.0	0.00
92.00	2.89	-4.95	-25.5	0.40
98.80	2.81	-5.45	-27.1	0.11
104.20	2.12	-5.44		0.41
110.00	2.82	-5.40	-27.0	0.25