ERRATUM

CO$_2$ air–sea exchange due to calcium carbonate and organic matter storage, and its implications for the global carbon cycle

Abraham Lerman · Fred T. Mackenzie

In our paper in Aquatic Geochemistry (2006) 11: 345–390, in Table A.2, through our oversight, an incorrect set of numbers was included in one column. The published numbers are by a factor of 6 greater than the correct values that are given in the revised table here. Table A.2 describes the computational steps in the release of CO$_2$ from a model surface ocean layer 50 m in thickness; the erroneous numbers refer to a 300-m-thick surface layer: these are the five non-zero values in the table's third column from the left, under the heading Mass calcite removed (yM_w), 10^{12} mol. In the process of further checking of the table, small and not significant differences of about 0.001–0.002 were found in the third digits after the decimal point in the values of Change in total alkalinity (column 5 from the left), some values of the pH (column 6 from the left), and some of the [CO$_2$] final concentrations (lower part of Table A.2, column 4 from the right), as well as the last value of Calcite saturation Ω (lower part of the Table A.2, column 5 from the right) that is corrected to 1.17 from the previous value of 1.18. These small differences are likely attributable to transcription of the final calculation results and they are corrected in the revised Table A.2.

A. Lerman (✉)
Department of Geological Sciences, Northwestern University,
Locy Hall, 1850 Campus Drive, Evanston,
IL 60208, USA
e-mail: alerman@northwestern.edu

F. T. Mackenzie
Department of Oceanography, University of Hawaii,
1000 Pope Road, MSB-525 Honolulu,
Hawaii 96822, USA

Table A.2 Release of CO_2 from $CaCO_3$ formation and atmospheric CO_2 increase from a 50-m-thick euphotic zone at 25°C and an initial P_{CO_2} = 195 ppmv; water mass in euphotic zone M_w = 1.854 × 10^19 kg (Figure 2a)

Precipitation of $CaCO_3$ and increase of $[CO_2]$

Fraction of DIC_0 removed f	Mass C or Ca removed/kg (y) 10^{-3} mol/kg	Mass calcite removed $(y\,M_w)$ 10^{12} mol	Change in DIC $(DIC_0 - y)$ 10^{-3} mol C/kg	Change in total alk. $A_{t,0} - 2y$ 10^{-3} mol/kg	Eq. (A.3) pH	Change in $[Ca^{2+}]$ $[Ca^{2+}]_0 - y$ 10^{-2} mol/kg	In solution $[CO_2]$ mol/kg	Internal P_{CO_2} ppmv	$[CO_2] \times M_w$ n_w 10^{12} mol
0.000	0	0	2.190	2.808	8.350	1.028	5.537E−06	195	102.6
0.001	0.0022	40.6	2.188	2.803	8.348	1.028	5.555E−06	196	103.0
0.010	0.0219	406	2.168	2.764	8.334	1.026	5.729E−06	202	106.2
0.100	0.219	4,060	1.971	2.370	8.159	1.006	8.353E−06	294	154.8
0.200	0.438	8,120	1.752	1.932	7.836	0.984	1.682E−05	592	311.7
0.450	0.986	18,270	1.205	0.837	6.207	0.929	3.708E−04	13,061	6874.5

Equilibration in an open system
1st approximation of CO_2 transfer   Final results

Fraction of DIC_0 removed f	$[CO_2]$ mass transferred Eq. (A.10) x mol	CO_2 in ocean water $n_w - x$ mol	CO_2 in atmosphere $n_a^0 + x$ mol	DIC 10^{-3} mol/kg	pH Eq. (A.4)	$[CO_3^{2-}]$ 10^{-3} mol/kg	Calcite saturation Ω	$[CO_2]$ mol/kg	Atmosphere P_{CO_2} ppmv	DIC released as CO_2 Eq. (A.8) $\Delta[DIC]$ 10^{-3} mol/kg	θ mol/mol
0.000	0	1.026E+14	3.487E+16	2.190	8.350	0.459	11.05	5.537E−06	195.0	0	
0.001	3.454E+11	1.026E+14	3.487E+16	2.187	8.349	0.458	11.02	5.539E−06	195.1	0.0008	0.383
0.010	3.564E+12	1.026E+14	3.487E+16	2.160	8.343	0.447	10.74	5.561E−06	195.9	0.0084	0.385
0.100	5.206E+13	1.028E+14	3.492E+16	1.883	8.279	0.346	8.15	5.796E−06	204.1	0.0880	0.402
0.200	2.085E+14	1.032E+14	3.507E+16	1.567	8.192	0.244	5.62	6.082E−06	214.2	0.1852	0.423
0.450	6.752E+15	1.225E+14	4.162E+16	0.724	7.836	0.054	1.17	6.951E−06	244.8	0.4807	0.488