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CEE 680: Water Chemistry

Lecture #39

Precipitation and Dissolution: Metal Carbonates

(Stumm & Morgan, Chapt.7)

Benjamin; Chapter 8.7-8.15

Me-Carbonate Equilibria

- From Pankow

$$MCO_{3(s)} = M^{2+} + CO_3^{2-} \qquad K_{s0} = [M^{2+}][CO_3^{2-}] \qquad (12.1)$$

$$M^{2+} + OH^- = MOH^+ \qquad K_{H1} = \frac{[MOH^+]}{[M^{2+}][OH^-]} \qquad (12.2)$$

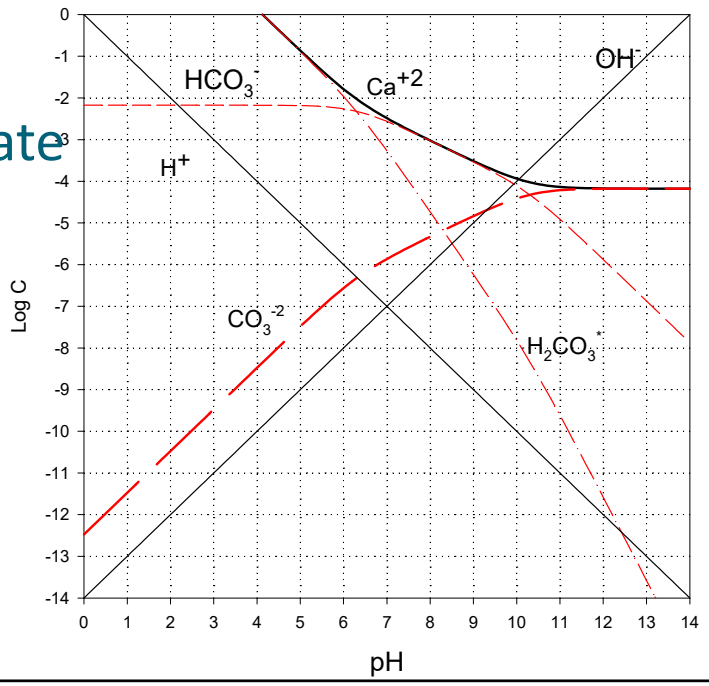
$$MOH^+ + OH^- = M(OH)_2^o \qquad K_{H2} = \frac{[M(OH)_2^o]}{[MOH^+][OH^-]} \qquad (12.3)$$

$$M(OH)_2^o + OH^- = M(OH)_3^- \qquad K_{H3} = \frac{[M(OH)_3^-]}{[M(OH)_2^o][OH^-]}. \qquad (12.4)$$

pH for initially-pure water (i.e., $(C_B' - C_A') = 0$) in equilibrium @ 25°C/1 atm with a divalent metal carbonate.

Metal Ion	$\log K_{s0}$	$\log K_{H1}$	$\log K_{H2}$	$\log K_{H3}$	exactly using Eq. (12.17)	approximately using Eq. (12.26)
Mg^{2+}	−7.46	2.58	–	–	10.19	10.29
Ca^{2+}	−8.30	1.3	–	–	9.96	10.01
Ba^{2+}	−8.30	0.64	–	–	9.96	10.01
Sr^{2+}	−9.03	0.82	–	–	9.73	9.77
Mn^{2+}	−9.30	3.4	3.4	1.0	9.63	9.68
Zn^{2+}	−10.00	5.0	6.0	2.5	9.24	9.44
Fe^{2+}	−10.68	4.5	2.9	2.6	8.93	9.22
Pb^{2+}	−13.13	6.3	4.6	3.0	8.20	8.40
Cd^{2+}	−13.74	3.9	3.8	2.6	7.88	8.20

Calcium Carbonate



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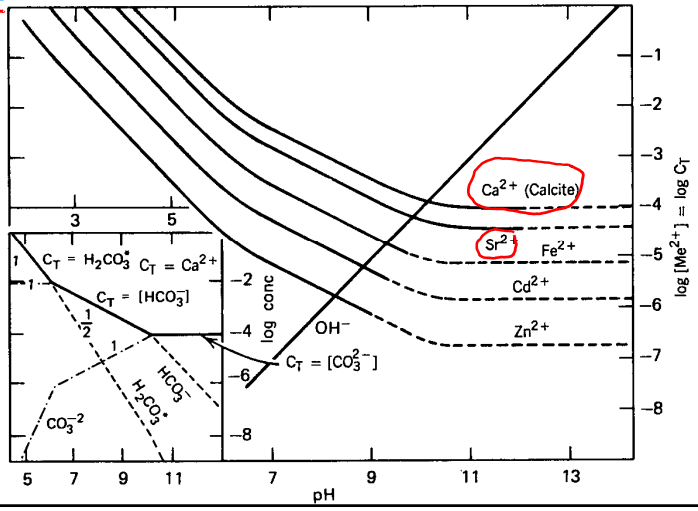
Other Me-Carbonates I

- Pure water



Stumm & Morgan, 1996, Figure 7.9, pg. 377

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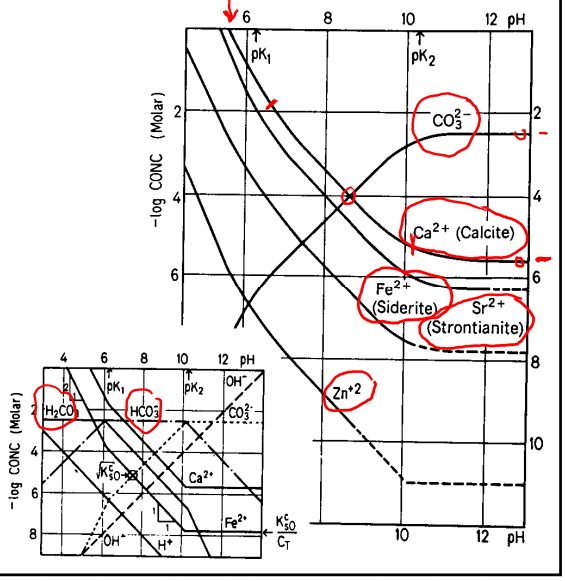
Other Me-carbonates II

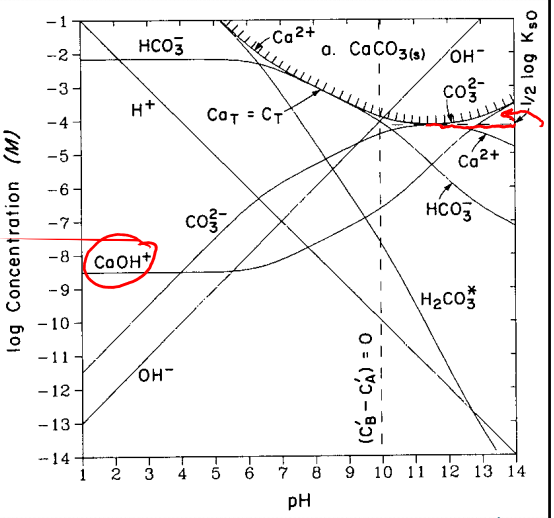
- Closed System with constant C_T derived from other species
  - $3x10^{-3}$ M

Stumm & Morgan, 1996, Figure 7.8, pg. 374



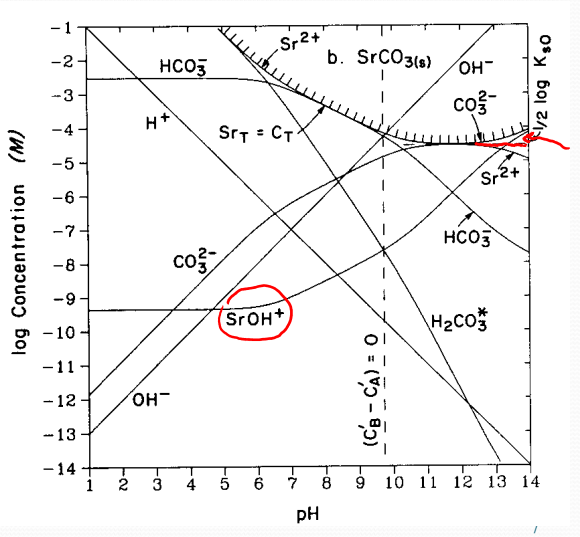
Calcium Carbonate

- Closed System
- Including hydroxide species
  - From Pankow



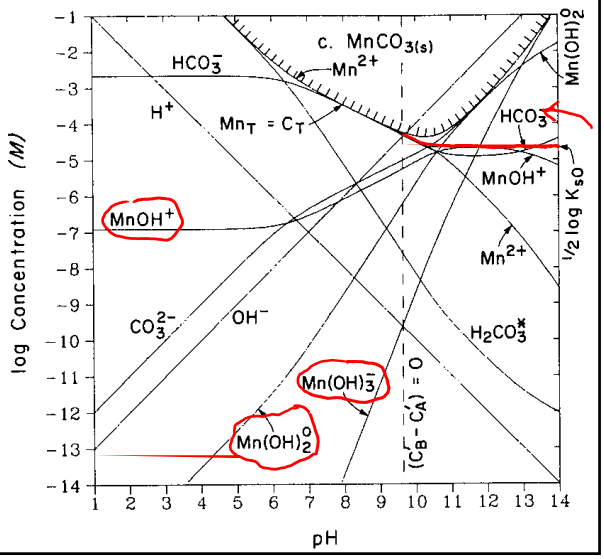
Strontium Carbonate

- Closed System
- Including hydroxide species
  - From Pankow



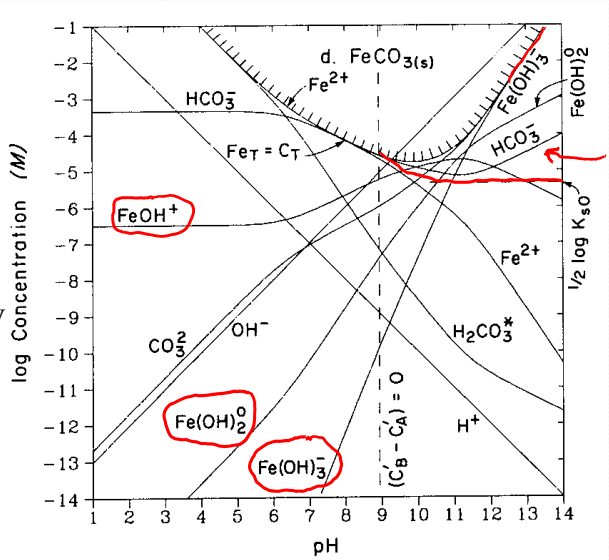
Manganous Carbonate

- Closed System
- Including hydroxide species
  - From Pankow



Ferrous Carbonate

- Closed System
- Including hydroxide species
  - From Pankow



- To next lecture