

Chemical Oceanography is taught every year for incoming graduate students and interested students from other departments. The course meets three times per week. Two of those sessions are lectures and the third is used to discuss a journal paper or a problem in a cooperative-learning, class-room discussion environment. There are five journal article discussions and five problems. Course outline and reading are presented below.

Chemical Oceanography (Ocean 529b), COURSE OUTLINE, Autumn 2002

Steve Emerson, Instructor; Erin Breckel, T.A.

<i>Week</i>	<i>Theme and Class Period Topic</i>	<i>Problems, Reading and Tests</i>
1&2 Oct. 7 Oct. 14	Introduction and Marine Mass Balance Salinity, Major Ions, Gases, Metals General Ocean Circ., Ocean Bio Chem. Mass Balance, Residence Time Hydrothermal Circulation Reading Discussion Question Period	Problem #1 Due Reading Due; Mottl and Wheat (1994) 20 minute Test
3&4 Oct 21 Oct 28	Carbonate Chemistry, Glob. C Balance Thermodynamics and Equilibrium Ocean pH, Alkalinity and DIC Reading Discussion Fossil Fuel CO ₂ and the Revelle Factor Oxygen and CO ₂ , Atm O ₂ /N ₂ Ratios Question Period	Reading; Sarmiento and Gruber (2002) Problem #2 Due 20 Minute Test
5&6 Nov. 4 Nov. 11	Life in the Ocean Redox, Photosynthesis, Resp., RKR Stable Isotopes: ¹³ C as tracer Reading Discussion Holiday Radioisotopes: ²³⁴ Th as particle tracer Question Period	Reading Due; Boyd et al. (2000) Problem #3 Due 20 Minute Test
7&8 Nov. 18 Nov. 25	Sediments: Org. C; CaCO₃, SiO₂ Kinetics: Organic matter diagenesis Thermo. and Kinetics: SiO ₂ Pres. Reading Discussion Thermo. and Kinetics: CaCO ₃ Pres. Question Period Holiday	Reading: Michalopoulos and Aller (1995) Problem #4 Due 20 Minute Test
9&10 Dec. 2 Dec. 9	Paleoceanography $\delta^{18}\text{O}$ -H ₂ O; Ocean T and Ice Volume Trace Metals and Ocean Circulation Reading Discussion Ice Cores: CO ₂ , CH ₄	Reading Due; Atkins and Schrag (2001) Problem # 5 Due

	Sed. and Ice core Records: $\delta^{18}\text{O}-\text{O}_2$ Question Period	20 Minute Test
--	--	----------------

Chemical Oceanography (Ocean 529b)
BIBLIOGRAPHY of Discussion Papers and Supplemental Reading
Autumn, 2002

Block	Discussion Papers	Supplemental Reading
1	Mottl and Wheat (1994)	E&H Book, Chapter 1, Pilson (1998) Chapt. 4
2	Sarmiento and Gruber (2002)	Pilson (1998) Chapter 7
3	Boyd et al. (2000)	Broecker and Peng (1982) pg 1-15
4	Michalopoulos and Aller (1995)	E&H Book, Chapter 10
5	Atkins and Schrag (2001)	Broecker (1995) Chapter 3

DISCUSSION PAPERS:

- Mottl, J.M. and C.G. Wheat (1994) Hydrothermal circulation through mid-ocean ridge flanks: Fluxes of heat and magnesium, *Geochim. Cosmochim. Acta*, 58, 2225-2237.
- Sarmiento, J.L. and N. Gruber (2002) Sinks for Anthropogenic Carbon, *Physics Today*, August 2002.
- Boyd, P. W. et al. (2000) A mesoscale phytoplankton bloom in the Southern Ocean stimulated by iron fertilization, *Nature*, 407, 695-702.
- Michalopoulos, P. and R. C. Aller (1995) Rapid Clay mineral formation in Amazon Delta sediments: Reverse Weathering and Oceanic Elemental Cycles, *Science*, 270, 614-617 and
- Mackenzie, F. T. and L. R. Kump (1995) Perspectives, *Science*, 270, 587-587.
- Atkins, J. and D. Schrag (2001) Glacial bottom water salinity and temperature from $\delta^{18}\text{O}$ and Cl In sediment pore fluids, *Geophys. Res. Letters*, 28, 771-774.
and/or
- Schrag, D. g. Hampt and D. Murray (1996) Pore fluid constraints on temperature and oxygen isotopic composition of the Glacial Ocean, *Science*, 272, 1930-1932.

SUPPLEMENTAL REFERENCES (BOOKS ON RESERVE):

- Broecker, W.S. (1995) *The Glacial World According to Wally*, Eldigio Press, Palisades, N.Y. 313p.
- Broecker, W.S. and T.-H. Peng (1982) *Tracers in the Sea*, Eldigio Press, Palisades, N.Y., 690 p.
- Chester, R. (1990) *Marine Geochemistry*, Unwin Hyman, London, 698 p.
- Emerson, S. and J Hedges (2002) Chapters 1 and 10 of Book Manuscript
- Faure, G. (1986) *Principles of Isotope Geology*, Wiley and Sons, New York, 589 p.
- Libes, S.M. (1992) *An Introduction to Marine Biogeochemistry*, John Wiley and Sons, N.Y., N.Y., 734 p.
- Millero, F. (1996) *Chemical Oceanography*, CRC Press, Boca Raton, Fla., 469 p.

- Morel, F.M. and J.G. Hering (1993) *Principles and Applications of Aquatic Chemistry*, John Wiley and Sons, N.Y., N.Y., 588 p.
- Pilson, M.E.Q. (1998) *An Introduction to the Chemistry of the Sea*, Prentice Hall, Upper Saddle River, N.J., 431.