



# SYLLABUS

Geology 215

PALEONTOLOGY OF MARINE LIFE

Soja

Constance M. Soja  
Office: Ho 342-343, x 7200  
Office Hours: 8:30-9:45 am T & H

Lectures: 9:55-11:10 am T & H  
Laboratory: 1:20-4 pm  
csoja@colgate.edu

Textbook: **Prothero, D.R. 2004. *Bringing Fossils to Life*. 2<sup>nd</sup> ed. McGraw-Hill.**  
& *optional* —> Boardman, R.S., Cheetham, A.H., and Rowell, A.J. (eds.) 1987.  
*Fossil Invertebrates*. Blackwell Scientific Publications, 713 p.

I. INTRODUCTION TO PALEONTOLOGY		
M	Course introduction	Preface; Art. 1
T	Understanding the fossil record	vi-viii; Ch. 1:168
H	Taxonomy: Invertebrate classification I	Ch. 2-4; H/w
T	Invertebrate classification II	Discussion of h/w
H	Principles of evolution	Ch. 3, 5
T	Taphonomy	Ch. 1
II. MARINE ENVIRONMENTS & PALEOECOLOGY		
H	Marine ecosystems & trophic relationships	Ch. 7, 8
T	Climate, plate tectonics & reefs	Ch. 8, 9
H	Reef ecology & guilds	Ch. 8
Sat	<b>*** FIELD TRIP ***</b>	Required
III. REEF CONSTRUCTORS & BINDERS THROUGH TIME		
T	Precambrian stromatolites & reefs	Ch. 11, 19
H	Protoctists (plankton)	Ch. 11
T	Porifera (sponges)	Ch. 12, Ch. 7:108-110
H	Origin of metazoans & animals in reefs	Art. 3-5
T	<b>FALL BREAK</b>	No class (labs meet)
H	Cnidaria (coral clones & colonies)	Ch. 12
IV. REEF DWELLERS, ENCRUSTERS, & LEVEL-BOTTOM COMMUNITIES		
T	Annelids (worms) & arthropods (trilobites, etc.)	Ch. 14, Ch. 7:111-112
H	Burgess Shale (& in-class video)	Ch. 1:15; Art. 6
T	Bryozoa (moss animals) & brachiopods (lamp shells)	Ch. 13, 8
H	<b>MIDTERM EXAM</b>	
T	<b>No class</b>	GSA meeting
H	Mollusks I: Bivalves (clams)	Ch. 15, Ch. 7:110-111
T	Mollusks II: Gastropods (snails)	Ch. 15
H	Echinoderms: Asterooids (starfish), echinoids (urchins) & crinoids (sea lilies)	Ch. 16
T	Hemichordata: Graptolites	Ch. 17, 10

V. REEF PREDATORS & “DESTROYERS”		
H	Mollusks III: Cephalopod predators	Ch. 15
T	“Incredible Suckers” video	
H	<b>THANKSGIVING</b>	<b>No class</b>
T	Mass extinctions & the Mesozoic Marine Revolution	Ch. 5, 6, 8
H	Ichnofossils (“destroyers” – borers, drillers & rasps) & ichnofacies	Ch. 8:143-147; Ch. 18
VI. GLOBAL CHANGE & REEFS		
T	Coral reefs, childhood obesity & “thinking outside the box”	Art. 7 & 8
H	Global perspective on mass extinctions & reefs	Ch. 6; Art. 9 & 10
M-F	<b>FINAL EXAM</b>	Comprehensive



### Additional Reading Assignments

(articles and book chapters available via Moodle)



- 1: ScienceDaily. 28 Oct 2009. What are coral reef services worth? [www.sciencedaily.com/releases/2009/10/091016093913.htm](http://www.sciencedaily.com/releases/2009/10/091016093913.htm)
- 2: Benyus, J.M. 2004. Tips to make your writing soar.
- 3: Wood, R.A. 2003. Evolution of reefs, *in* Briggs & Crowther:57-62.
- 4: Erwin, D.H. 2003. Metazoan origins and early evolution, *in* Briggs & Crowther:13-21.
- 5: Kiessling, W. et al. 2010. Reefs as cradles of evolution and sources of biodiversity in the Phanerozoic. *Science*, 327 (5962):196-198.
- 6: Gould, S.J. 1989. Wonderful Life: The Burgess Shale and the Nature of History. Chapter 3 – Reconstruction of the Burgess Shale; 207-212; SCAN: 218-239.
- 7: Nelson, L. 2004. Venomous snails: One slip, and you’re dead... *Nature*, 429:798-799.
- 8: Diaz, R.J. and Rosenberg, R. 2008. Spreading dead zones and consequences for marine ecosystems. *Science*, 321:926-929.
- 9: Kolbert, E. 2009. Why are we so fat? *The New Yorker*, 20 July 2009:1-7.
- 10: Jackson, J.B.C. 2008. Ecological extinction and evolution in the brave new ocean. *PNAS*, 105:11458-11465.
- 11: Harrould-Kolieb, E., Huelsenbeck, M., and Selz, V. 2010. Ocean Acidification: The Untold Stories, 24 p. Oceana, Washington, DC. [www.oceana.org/climate](http://www.oceana.org/climate)
- 12: Rudolf, J.C. 2011. Under the sea, coral reefs in peril. *The New York Times*, 4 June 2011. [www.nytimes.com/2011/06/05/weekinreview/05reefs.html](http://www.nytimes.com/2011/06/05/weekinreview/05reefs.html)
- 13: Veron, J.E.N. 2008. Mass extinctions and ocean acidification: Biological constraints on geological dilemmas. *Coral Reefs*, 27:459-472.

### Laboratories and Field Trip

Weekly laboratory exercises are designed to complement and enliven lecture material on the preservation, paleoecology, classification, and identification of invertebrate organisms that inhabited reef and adjacent environments. Emphasis is placed on learning paleontological techniques (including dissections), recognizing fossil genera and different invertebrate phyla,

and discussing special themes in paleontology. The first lab counts 30 points; each successive lab (2-13) is worth 10 points. One 70-point lab quiz is scheduled for the last week of the term.

LAB	TOPIC
1	Marine ecosystem services
2	“Gridiron” geologic time
3	Fossilization
4	Fossils as paleoenvironmental indicators
<b>FT</b>	<b>Required field trip</b>
5	Protoctists (marine plankton)
6	Porifera (sponges)
7	Cnidaria (anemones, corals & jellyfish)
8	Trilobites & other arthropods (shrimp, crabs, etc.)
9	Bryozoa & brachiopods (moss animals & lamp shells)
	<b>No lab (GSA meeting)</b>
10	Bivalves (clams)
11	Gastropods (snails) & cephalopods ( <i>Nautilus</i> , etc.)
	<b>Thanksgiving – no lab</b>
12	Echinoderms (starfish, urchins, sea lilies, etc.)
13	<b>LAB QUIZ; Ichnofossils (trace fossils)</b>

meet at  
football  
stadium

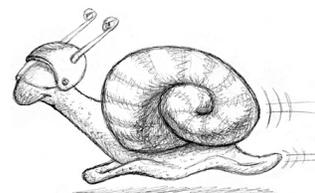
### Grade Assessment – Lecture

Colgate has a fractional course credit system. That means students earn 1.25 course credits in geology lecture & lab courses. Grades are submitted for both the lecture and lab components (these show up as separate line items on your transcript), and students must satisfactorily pass both the lecture and lab to earn course credit.

In the lecture part of the course, the final grade will be determined from the cumulative score you earn on one homework assignment, two exams, completion of a field trip report, laboratory component (see below), and participation. Class attendance and participation in lecture, classroom discussions, lab, and the field trip will also count in the student's favor.

Points will be awarded as follows:

Homework Assignment	30 points
Midterm Exam	100 "
Field trip	50 "
Final Exam	150 "
Participation	50 "
Laboratory component	220 "
Total	<hr/> 600 points possible



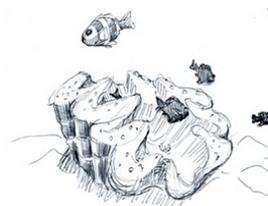
### Grade Assessment – Lab

In the laboratory part of the course, the final grade will be determined from the cumulative score you earn on 13 lab reports and a lab quiz. Notice that the grade you earn in the lab will be computed as part of your overall lecture grade. In the past, students have tended to do very well in the lab (**but could do better on the lab quiz**). On average, points earned in

the lab have had a neutral impact or, more commonly, enhanced the final lecture component grade by 1-10%.

Points in the lab will be awarded as follows:

Lab 1 exercise	30 points
Lab 2-13 exercises	120 "
Lab quiz	70 "
Total	<hr/> 220 points possible



The following grading standards will apply in lecture and lab:

<b>A+</b>	Excellent (Superlative). Basically faultless, the work is well beyond that expected at this level of study.
<b>A</b>	Excellent (Outstanding). Consistent work of high distinction, mostly with an absence of errors. Significant depth of understanding and comprehensive range of up-to-date material; clear and analytical focus fully explores the subject. Coherent prose shows logical, ordered thought as well as the highest standards in correct use of spelling and grammar.
<b>A-</b>	Excellent. Overall outstanding work (as described above), but a few, minor flaws or some less-than-coherent prose, etc. suggest minor inconsistencies in knowledge and logic.
<b>B</b>	Very Good. Solid work of high quality overall with very good range of up-to-date material but with some gaps. Shows a firm grasp of the subject and current theory but needs to include some additional evidence of further reading and deeper understanding. Clear and coherent structure shows ordered thought, but inaccuracies or flaws in logic detract somewhat from an overall evaluation of excellence. Demonstrates very good standard in use of spelling and grammar.
<b>C</b>	Good. Satisfactory, solid work overall. Knowledge is generally sound but may be limited. Inaccuracies are relatively minor. Understands the subject but does not have a firm grasp and depth of understanding of all of the key concepts. Reasonably clear and coherent structure, generally presenting ideas and information in a logical way. Generally well written, but there may be inaccuracies about content and also flaws in use of spelling and grammar.
<b>D</b>	Less-than-satisfactory/Pass. Basic knowledge of the key issues is evident, but there are significant inaccuracies and omissions. Lacks detail, elaboration, or explanation of the key concepts and ideas. Shows poor logic; arguments and conclusions may be weak or lack clarity with unsubstantiated statements. Shows weakness in presentation, spelling, and grammar.
<b>F</b>	Less-than-satisfactory/Fail. Little knowledge is demonstrated or is limited in scope, accuracy, and logic. Understanding of key concepts is limited, lacking, or may be confused. Irrelevant or erroneous material may be included. Lacks coherent critical analysis and discussion, and prose is confusing with little attempt to order the material in a systematic way. Very poor writing style.

### Classroom as Community / Academic Honor Code

The success of this class depends in large part on you, particularly your interest, enthusiasm, dedication to learning, and willingness to abide by Colgate's academic honor code.

**Consistent class attendance** and **being up-to-date on reading assignments** are the two most important ways in which to demonstrate your commitment to the class and to the other students enrolled. Those of you who are consistently late for class, sleepy or drowsy, or absent on a regular basis (Thursday mornings, in particular) diminish the classroom experience for all involved by sending a message that the course is not a high priority in your academic life.

Woody Allen said, "90 percent of life is just showing up"— thus *class attendance*, participation in classroom discussions-debates-exercises, enthusiasm, and improvement in performance through the semester will also count in your favor when deciding the final grade. (In other words, *class attendance is expected*). Please note that those who miss more than one or two

“sick days,” are consistently late or unprepared for class or lab, or are drowsy or inattentive or nonparticipatory in class (or lab) will receive a poor evaluation for participation (points drop off *sharply* after two missed classes), which will have a negative impact on the overall course grade. Finally, please note that class begins promptly at 9:55 a.m. – to avoid disruption, **students are not welcome to enter the classroom once class has begun (seriously).**

### Technology in the Classroom

*I am not a fan of laptops in the classroom.* Why? – experience shows that students *learn better* when they are actively taking hand-written notes while listening *and* viewing images that relate to topics being discussed; laptops offer a greater variety of distractions to the user and those sitting nearby than do notes taken on paper; and laptops can create a physical/interactive barrier between the user and others in the classroom. Seriously – *learning is enhanced* by hand-writing, rather than typing, a good set of notes (where each hand-written letter sends a signal to the brain and is linked to a word that has meaning, unlike what happens when typing on a keyboard). ***Bottom line: unless you have special needs (please arrange a time to discuss these with me before our second class meeting), please do not plan to use your laptop in class.***

Please note that Power Point presentations or graphics shown in class will not be posted on Moodle (these are proprietary while working on a book for this course). Ppt. images are based on diagrams drawn on the chalkboard or are images similar to those in the assigned readings and (or) on the recommended websites. Students who have done well in this course in the past were diligent about: **1.** writing up a really good set of lecture and lab notes; **2.** checking with classmates about any gaps in their notes; **3.** staying on top of the reading (and incorporating notes from assigned readings – including the textbook! – into their notebooks); **4.** paying close attention to images in the assigned readings; and **5.** asking me questions during class or office hours.

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### Make-up Exam Policy

No make-up exams will be given for a student absent from the Midterm unless extraordinary circumstances (serious illness or family emergency; both must be confirmed by Class Dean) are involved. If you cannot be present for the exam, you must notify me beforehand – either by contacting me directly or by leaving a message at ext. 7200. It is *your* responsibility to make arrangements with me to take a make-up exam, which must be scheduled *within two lectures* of the original exam date. No make-up exams will be given for the Final Exam (Colgate policy).

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### Additional Library (or Lab) Resources: Classic – and Newer – Texts

- Allison, P.A. and Briggs, D.E.G. (eds.) 1991. *Taphonomy: Releasing the Data Locked in the Fossil Record*. Plenum Press, 560 p.
- Beerbower, J.R. 1968. *Search for the Past*. Prentice-Hall, 512 p.
- Black, R.M. 1988. *The Elements of Palaeontology*. 2nd ed. Cambridge University Press, 404 p.
- Boardman, R.S., Cheetham, A.H. and Rowell, A.J. (eds.) 1987. *Fossil Invertebrates*. Blackwell, 713 p.
- Bosence, D.W.J. and Allison, P.A. (eds.) 1995. *Marine Palaeoenvironmental Analysis from Fossils*. Geological Society, London, 272 p.
- Briggs, D.E.G. and Crowther, P.R. (eds.) 2003. *Palaeobiology II*. Blackwell, 583 p.

- Briggs, D.E.G., Erwin, D.H., and Collier, F.J. 1994. *The Fossils of the Burgess Shale*. Smithsonian Institution Press, 238 p.
- Brusca, R.C. and Brusca, G.J. 1990. *Invertebrates*. Sinauer Associates, 922 p.
- Clarkson, E.N.K. 1993. *Invertebrate Palaeontology and Evolution*. 3rd ed. Allen & Unwin, 382 p.
- Dodd, J.R. and Stanton, R.J. 1990. *Paleoecology, Concepts and Applications*. 2nd ed. Wiley, 557 p.
- Donoghue, P.C.J., and Smith, M.P. 2004. *Telling the Evolutionary Time: Molecular Clocks and the Fossil Record*. CRC Press, 288 p.
- Donovan, S.K. (ed.) 1991. *The Processes of Fossilization*. Columbia University Press, 303 p.
- Erwin, D.H. 2006. *Extinction: How Life on Earth Nearly Ended 250 Million Years Ago*. Princeton University Press, 296 p.
- Erwin, D.H., and Wing, S.L. (eds.) 2000. *Deep time: Paleobiology's Perspective*. Paleontological Society, 371 p.
- Fairbridge, R.W. and Jablonski, D. 1979. *The Encyclopedia of Paleontology*. Dowden, Hutchinson & Ross, 886 p.
- Fortey, R. 2002. *Fossils: The Key to the Past*. Smithsonian Institution Press, 232 p.
- Haq, B.U. and Boersma, A. 1978. *Introduction to Marine Micropaleontology*. Elsevier, 376 p.
- Howard, D.J., and Berlocher, S.H. (eds.) 1998. *Endless Forms: Species and Speciation*. Oxford University Press, 470 p.
- Jackson, J.B.C., Lidgard, S., and McKinney, F.K. (eds.) 2001. *Evolutionary Patterns: Growth, Form, and Tempo in the Fossil Record*. University of Chicago Press, 399 p.
- Lane, R.H., Steininger, F.F., Kaesler, R.L., Ziegler, W., and Lipps, J. (eds.) 1997. *Fossils and the Future: Paleontology in the 21<sup>st</sup> Century*. Senckenberg-Buch Nr. 74, 290 p.
- Margulis, L. and Schwartz, K.V. 1988. *Five Kingdoms: An Illustrated Guide to the Phyla of Life on Earth*. 2nd ed. Freeman, 376 p.
- Moore, R.C. (ed.) *Treatise on Invertebrate Paleontology*. Parts A-X. University of Kansas Press.
- Moore, R.C., Lalicker, C.G. and Fisher, A.G. 1952. *Invertebrate Fossils*. McGraw-Hill.
- Murray, J.W. (ed.) 1985. *Atlas of Invertebrate Macrofossils*. Longman Scientific & Technical, 241 p.
- Newton, C.R. and Laporte, L.F. 1989. *Ancient Environments*. 3rd ed. Prentice-Hall, 178 p.
- Nield, E.W. and Tucker, V.C.T. 1985. *Palaeontology, An Introduction*. Pergamon Press, 178 p.
- Raup, D.M. and Stanley, S.M. 1978. *Principles of Paleontology*. 2nd ed. Freeman, 481p.
- Simpson, G.G. 1983. *Fossils and the History of Life*. Scientific American Books, 239 p.
- Valentine, J.W. 1985. *Phanerozoic Diversity Patterns*. Princeton University Press, 441 p.
- Zhuravlev, A.Y., and Riding, R. 2000. (eds.) *The Ecology of the Cambrian Radiation*. Columbia University Press, 576 p.

*“The diversity of life forms,  
so numerous that we have yet to identify most of them,  
is the greatest wonder of this planet.”*

– E.O. Wilson (1988)

