MSL215 – MARINE GEOLOGICAL DRAMA AND UNDERSEA CATASTROPHES

Tuesday/Thursday 2:00 – 3:30 pm
214 O'Neill

INSTRUCTOR
Dr. Jennifer Reynolds, Associate Professor
Office hours: Mon and Wed 1-3 pm or by appointment
Office location: 209B O'Neill
Office phone: 474-5871 Email: jreynolds@alaska.edu

COURSE DESCRIPTION
Case studies of geological events that disrupt the ocean environment serve as an introduction to
geological oceanography and its connections to other aspects of ocean and Earth history.

Case studies covered in this course include both sudden geological events, on a time scale of minutes to
weeks, and slow-motion events on a geologic time scale. Both can have dramatic or even catastrophic
effects on the oceans and marine life.

Sudden geologic events include: Submarine volcanic eruptions. Tsunamis caused by earthquakes or
submarine landslides. Submarine landslides caused by gas hydrate decomposition or sector collapse of
volcanoes into the sea. Flooding of the Black Sea basin.

Slow-motion events include: The Archean oxygen crisis. Opening the Tasmanian Gateway. Closing the
Isthmus of Panama. Sequential growth and drowning of Hawaiian islands.

Geological concepts will be introduced as part of the background and context for each case study. These
concepts will include aspects of plate tectonic theory, the shape of the ocean basins, sediments, the
paleoceanographic record, and physical/chemical/biological interactions between geological materials and
the water part of the oceans. Tools and methods of geologic research will also be discussed.

This is a 3-credit core course designed for lower-division undergraduate students. It is offered as part of
the Minor in Marine Science, but the course is also suitable for students with an interest in geology and
other Earth science.

Prerequisites: MSL111X (The Oceans) or MSL211 (Introduction to Marine Science I) or permission of
the instructor. Prior knowledge of geology is not assumed, but students are expected to have a basic
understanding of oceanography. Students with a background in geology instead of oceanography are
invited to contact the instructor.

COURSE GOALS
Geological oceanography is one of the four core subjects in oceanography; the others are physical,
chemical, and biological oceanography. This course will introduce students to topics in geological
oceanography via the use of case studies. Oceanography is an inherently interdisciplinary field, and these
case studies are also intended as a way to teach students about the interaction of geological activity with
other aspects of the oceans such as ocean circulation, tsunamis, seawater composition, seabed ecology,
and the evolutionary history of marine species.

STUDENT LEARNING OUTCOMES
Students will gain an appreciation of (a) active geological processes in the oceans; (b) the concept that the
oceans function as a system including geological as well as physical, chemical and biological aspects; and
(c) the capacity of rocks and sediments to record the history of the oceans. Through case studies, students
will understand selected topics in greater depth. Students will also gain experience in analyzing, discussing, and writing about scientific topics.

COURSE READINGS / MATERIALS:
Reading assignments and course materials will be drawn from a variety of sources. They will be distributed electronically, through Blackboard and/or the department’s ftp site.

The one required text for this course (available in paperback) is

ASSIGNMENTS
Homework Exercises: Four homework exercises outside of class will be assigned to improve student understanding of geological concepts and methods. These exercises will cover construction and interpretation of contour maps of the seafloor; plate motion; use of presence and absence of species in sediments to date those sediments (biostratigraphy); and evidence of geological events in marine sediments.

Discussions/presentations: Students will be asked to do two short presentations (5 minute) on supplementary readings, as part of class discussions. These will be scheduled in advance and will be connected to the short essays.

Essays: Students will write 1-2 page essays on the case studies and related topics, four during the semester. Students will each have a set of topics and due dates, to be scheduled during the first or second class period. The purpose of the essays is both investigation/discussion of the course content and experience in writing on scientific topics. Essays are expected to reflect the student’s thinking on the subject, supported by content from course materials and individually assigned readings. Essays may be returned to the student for revision before grading.

Plagiarism is strictly prohibited and may result in a failing grade on the paper and/or the course. See the section below on Student Code of Conduct.

GRADING
Letter grades will be assigned. The grading scale is not curved. A = 100-93%, A- = 92-88%, B+ = 87-83%, B = 82-78%, B- = 77-73%, C+ = 72-68%, C = 67-63%, C- = 62-58%, D+ = 57-53%, D = 55-51%, D- = 50, F = < 50%. Late assignments and make-up exams must be approved by the instructor in advance, except for unanticipated and unavoidable absence (e.g., illness or emergency).

Assignments (see above): 50%. Homework exercises (20%) will be graded on complete and accurate answers, evidence that the student understands the material, and timely submission. Class presentations (10%) will be graded on whether the content fulfills the assignment and on effective communication with the audience. Essays (20%) will be graded on evidence that the student understands the material; original content that reflects the student’s thinking on the subject; presentation of the essay, i.e., spelling, grammar and coherent structure; and timely submission. Essays may be returned to the student for revision before grading.

Class participation: 15%. Students are expected to complete reading assignments on time and to contribute to thoughtful discussions of class topics, including any Blackboard discussions. Students who wish to work out a different mode of class participation may contact the instructor. This portion of the grade includes class attendance (5%).

Midterm exam: 10%. Final exam: 25%.

STUDENT CODE OF CONDUCT
Students are expected to conduct themselves according to the standards described in the UAF Student Code of Conduct (see catalog: http://www.uaf.edu/catalog/current/academics/regs3.html). The expectations for academic honesty and integrity are particularly emphasized.

Students who are unsure about plagiarism and proper attribution of the work of others are encouraged to consult with the instructor. Often the most difficult type for students to avoid is plagiarism via paraphrasing. The UAF library system provides guidance and examples (http://library.uaf.edu/ls101-plagiarism).

**STUDENT SUPPORT SERVICES**
The Writing Center (http://www.uaf.edu/english/writing-center/) offers tutorial and fax-tutorial assistance with grammar, composition, and style. Students connected to the UAF network (Ethernet or wireless on-campus or through VPN off-campus) have access to UAF Library catalogs, electronic journal holdings, and interlibrary loan resources. Miscellaneous support services (e.g., tutorial services, instruction in mathematics skills, academic advising, mentoring and personal support, cultural and social engagement, use of laptop computers, labs, and other technology resources, and direct financial assistance to qualified low-income participants) are available through UAF Student Support services (http://www.uaf.edu/sss/).

**DISABILITIES SERVICES**
The instructor welcomes students with disabilities, and will work with them to provide reasonable accomodation. Contact the instructor with any concerns.

Office of Disabilities Services: 208 WHITAKER BLDG, 474-5655

**CALENDAR (Spring 2015), subject to modification:**

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Jan 15</td>
<td>Introduction, overview of marine geology</td>
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<tr>
<td>2</td>
<td>Jan 20</td>
<td>Background on mid-ocean ridges, submarine volcanic eruptions</td>
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<td>Jan 22</td>
<td>Case 1: Submarine eruptions at Axial Seamount, Juan de Fuca Ridge</td>
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<td>Jan 27</td>
<td>Case 1 continued.</td>
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<td>Jan 29</td>
<td>Homework exercise #1 due, contour maps of the seafloor.</td>
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<td>Background on subduction zone earthquakes, tsunamis</td>
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<td>4</td>
<td>Feb 3</td>
<td>Case 2: Great Sumatra-Andaman Earthquake and tsunami, 2005</td>
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<td>Feb 5</td>
<td>Background on seabed gas hydrates (clathrates) and submarine landslides</td>
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<td>5</td>
<td>Feb 10</td>
<td>Case 3: Storegga Slide in the North Sea</td>
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<td>Feb 12</td>
<td>Case 4: landslide-generated tsunami in Papua New Guinea, 1998</td>
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<td>6</td>
<td>Feb 17</td>
<td>Background on sector collapse of volcanoes and submarine landslides</td>
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<td>Feb 19</td>
<td>Case 4: Sector collapse in the Hawaiian Islands and elsewhere.</td>
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<td>7</td>
<td>Feb 24</td>
<td>Case 4 continued</td>
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<td>Feb 26</td>
<td>Homework exercise #2 due, plate motion.</td>
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<td>8</td>
<td>Mar 3</td>
<td>Discussion, review for midterm exam</td>
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<td><strong>Midterm exam</strong></td>
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<td>Date</td>
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<td>Mar 5</td>
<td>Case 5: The Archean oxygen crisis</td>
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<td>Week 9</td>
<td>Mar 10 Background history of the Black Sea, Mediterranean Sea, ocean drilling</td>
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<td>Mar 12</td>
<td>Case 6: Flooding of the Black Sea basin</td>
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<td>Mar 17-19</td>
<td><strong>Spring Break</strong></td>
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<td>Week 10</td>
<td>Mar 24 Case 6 continued</td>
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<tr>
<td>Mar 26</td>
<td>Case 6 continued</td>
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<td>Week 11</td>
<td>Mar 31 Contrast the Black Sea with other marginal basins</td>
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<td>Apr 2</td>
<td>Background on hotspot volcanoes and plate tectonics</td>
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<td>Week 12</td>
<td>Apr 7 Case 7: Sequential growth and drowning of Hawaiian volcanic islands</td>
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<td>Apr 9</td>
<td>Background on plate tectonics and marine geology around Antarctica</td>
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<td>Week 13</td>
<td>Apr 14 Case 8: Opening the Tasman Gateway</td>
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<td>Homework #3 due, biostratigraphy</td>
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<td>Apr 16 Background on geology of Central America, erosion and sedimentation</td>
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<td>Week 14</td>
<td>Apr 21 Case 9: Closing the Isthmus of Panama</td>
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<td>Apr 23</td>
<td>Background on the geological time scale, Earth history</td>
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<td>Week 15</td>
<td>Apr 28 Case 10: The Anthropocene (geological epoch of humans)</td>
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<td>Homework #4 due, evidence of geologic events in marine sediments.</td>
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<td>Apr 30 Discussion, review for final exam.</td>
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<td>May 8</td>
<td><strong>Final Exam 10:15 am - 12:15 pm.</strong></td>
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**READING ASSIGNMENTS**

Due Jan 20: This should be review for students who have taken MSL111 or MSL211.

Due Jan 22:
- NOAA PMEL web site on Axial Seamount: [http://www.pmel.noaa.gov/eoi/axial_site.html](http://www.pmel.noaa.gov/eoi/axial_site.html)
  Be sure to view the submarine videos.

Due Feb 3:

Due Feb 10:
Due Feb 12:

Due Feb 19:

Due March 5:

Due March 12:

Due March 24:

Optional:

Due April 7:

Due April 14:
- Exon, N. et al. (2000), The Opening of the Tasmanian gateway drove Cenozoic paleoclimatic and paleoceanographic changes: Results of Leg 189.  JOIDES Journal 26(2), pp. 11-17.
Due April 21:
- [http://odplegacy.org/outreach/brochures.html](http://odplegacy.org/outreach/brochures.html)

Due April 28:
- Zalasiewicz, J. et al. (2008), Are We Now Living in the Anthropocene?  GSA Today 18(2), pp. 4-8.