LSC Use Only Proposal No:
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UWUCC Action-Date: AP-4/10/12 Senate Action Date: App - 5/01/12

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

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Proposing Department/Unit **Geosciences**	Phone **x4469**

Check all appropriate lines and complete all information. Use a separate cover sheet for each course proposal and/or program proposal.

1. Course Proposals (check all that apply)

New Course	Course Prefix Change	Course Deletion
X Course Revision	Course Number and/or Title Change	Catalog Description Change

Current course prefix, number and full title: GEOS 151 Age of Dinosaurs

Proposed course prefix, number and full title, if changing:

2. Liberal Studies Course Designations, as appropriate

X This course is also proposed as a Liberal Studies Course (please mark the appropriate categories below)

Learning Skills [X] Knowledge Area Global and Multicultural Awareness Writing Across the Curriculum (W Course) Liberal Studies Elective (please mark the designation(s) that applies – must meet at least one)

Global Citizenship	Information Literacy	Oral Communication
Quantitative Reasoning	Scientific Literacy	Technological Literacy

3. Other Designations, as appropriate

Honors College Course Other: (e.g. Women's Studies, Pan African)

4. Program Proposals

Catalog Description Change	Program Revision	Program Title Change	New Track
New Degree Program	New Minor Program	Liberal Studies Requirement Changes	Other

Current program name:

Proposed program name, if changing:

5. Approvals	Signatur	Date
Department Curriculum Committee		3/19/12
Department Chairperson(s)		3/19/12
College Curriculum Committee Chair		3/28/12
College Dean		3/28/12
Director of Liberal Studies (as needed)		4/9/12
Director of Honors College (as needed)		
Provost (as needed)		
Additional signature (with title) as		
UWUCC Co-Chairs	Gail S Sechrist 4/10/12	Received

Received
APR 9 2012
Liberal Studies

Received
MAR 28 2012
Liberal Studies

Part II.

New Syllabus of Record

I. Catalog Description

GEOS 151 Age of Dinosaurs (3c-0l-3cr)

Prerequisites: No Geoscience Majors/Minors

A thorough introduction to dinosaurs and the world they inhabited. Topics include the most current theories regarding dinosaur biology (behavior, metabolism, evolution), ecology (greenhouse climate, and associated fauna and flora), and extinction.

II. Course Outcomes and Assessment (Expected Undergraduate Student Learning Outcomes)

At the conclusion of this course students should:

Objective 1:

Understand the basic elements of Plate Tectonics theory, and how geologic processes have controlled the conditions (climate, sea level, etc.) that prevailed on the surface of our planet at various times in Earth History.

Expected Student Learning Outcomes 1 and 2

Informed and Empowered Learners

Rationale:

Assignments and course content will familiarize students with the anatomy of our planet, in particular the tectonic plates that make up its surface, and the dramatic geologic processes driven by their interaction. Particular emphasis is placed on extrapolating what we know about how the planet operates today back into the deep past to reconstruct the world as it existed in the Mesozoic Era when dinosaurs ruled the continents.

Objective 2:

Be equally familiar with the process of Organic Evolution and be able to interpret the function(s) of various, often seemingly bizarre anatomical features of extinct (and extant) vertebrates by analyzing their potential value in promoting survival and/or reproductive success.

Expected Student Learning Outcomes 1and 2

Informed and Empowered Learners

Rationale:

Assignments and course content will challenge students to critically evaluate competing hypotheses regarding the adaptive advantage conferred upon extinct tetrapods (land vertebrates) by such structures as elongated neural spines (thermoregulatory "sail" vs. muscular bison-like hump), modified dentition and jaw apparatuses for specialized diets, pterodactyloid crests (breeding display or aerodynamics?), and ceratopsid horns (defense against predators vs. intra-specific sparring), among others.

Objective 3:

Appreciate the interconnected nature of all the elements of the Earth System (Lithosphere, Atmosphere, Hydrosphere, and Biosphere) and be cognizant of how changes in any of those four components produces changes in the others.

Expected Student Learning Outcomes 1 and 2

Informed and Empowered Learners

Rationale:

Assignments and course content will guide the students through the sequence of major tectonic events related to the assembly and subsequent fragmentation of the supercontinent Pangaea and how those events modified global and regional climates, and brought about dramatic changes in the plant life and tetrapod fauna on the continents.

Objective 4:

Fully understand the phenomenon of mass extinction, and data and methods of inquiry that are employed in assessing the contributing factors in the terminal Permian and terminal Cretaceous event(s) that led to the rise and fall of non-avian dinosaurs at the start and end of the Mesozoic Era, respectively.

Expected Student Learning Outcomes 1, 2 and 3

Informed, Empowered and Responsible Learners

Rationale:

Assignments and course content will engage students in evaluating the plausibility of myriad extinction mechanisms that have been proposed to explain past mass extinctions, introducing them to not only the scientific basis of such debates but also the potential distortion of findings through the public media. This also includes the politically charged controversy over whether we are witnessing the latest, human-induced mass extinction at the present time.

Objective 5:

Appreciate the limits of science, both in terms of acceptable levels of uncertainty, and with respect to facets of human activity that lie beyond the scope of scientific inquiry.

Expected Student Learning Outcomes 1, 2 and 3

Informed, Empowered and Responsible Learners

Rationale:

Course content will clarify for students that scientific investigation seldom (if ever) produces 100% certainty, but that 95-99% confidence levels form the basis of informed decisions. Discussion of the scientific basis of Organic Evolution and contrasting religious underpinning of such beliefs as Creation Science or Intelligent Design ensures that students grasp the distinction between science and religion.

III. Course Outline

Part A: Foundational principles in geology and biology — **7 hours**

1. A geological primer: Plate tectonics and sedimentary basins
2. A biological primer: Organic Evolution and phylogenetic analysis
3. The evolution-creation "controversy" and the limits of science

Part B: Major non-dinosaurian tetrapod groups — **3 hours**

1. The synapsid lineage: mammals and their predecessors
2. Marine reptiles: Ichthyosaurs, Plesiosaurs, and Mosasaurs
3. Pterosaurs: winged reptiles of the Mesozoic Era

Exam 1 — **1 hour**

Part C: Saurischian dinosaurs — **8 hours**

1. Order Theropoda: the carnivorous dinosaurs and their descendants
2. Sauropodomorphs I: the early versions ("Prosauropods")
3. Sauropodomorphs II: Order Sauropoda

Exam 2 — **1 hour**

Part D: Ornithischian dinosaurs — **12 hours**

1. Order Ornithopoda: small forms (Heterodontosaurs and Hypsilophodontids)
2. Order Ornithopoda: large forms (Iguanadontids and Hadrosaurs)
3. Orders Stegosauria and Ankylosauria: armored dinosaurs
4. Order Pachycephalosauria: the head-bangers
5. Order Ceratopsia: horned dinosaurs and their kin

Exam 3 — **1 hour**

Part E: Dinosaurian biology and ecology — **4 hours**

1. Land Plant evolution through the Mesozoic Era
2. Dinosaur metabolism: hot-blooded dinosaurs?
3. Dinosaur trace fossils: fossilized behavior

Part F: Mass extinction — **5 hours**

1. The terminal Permian event: setting the stage for dinosaur evolution
2. The K-T boundary event: demise of the (non-avian) dinosaurs

Cumulative final exam during final exam period.

IV. Evaluation Methods

Each component of the course will contribute to final grade according to:

Exam 1	15%
Exam 2	20%
Exam 3	25%
Final Exam	25%
Assignments	5%
Class Participation*	10%
Total	100%

*Participation score is a summary assessment, made at the very end of the term by the professor, of the degree of attentiveness, engagement, and contribution to the class activities by the student over the duration of the term. One valuable function it serves is to provide the professor a mechanism for bolstering the final percentages for students who have worked diligently and applied themselves fully to the course, but struggled with the fully objective exams for various reasons.

V. Example Grading Scale

The final grade for this course will be determined using the following schedule:

A=90-100%; B=80-89%, C=70-79%, D=60-69%, F=<60%

VI. Attendance Policy

The attendance policy will conform to IUP's undergraduate course attendance policy, as outlined in the undergraduate catalog.

VII. Required textbooks, supplemental books and readings

Text: Fastovsky, D.E. and Weishampel, D.B., 2009, Dinosaurs: a concise natural history: Cambridge University Press, 379p.

Supplemental readings:

Benton, M.J., 2003, When Life Nearly Died: Thames & Hudson, 455p. (specific sections assigned.)

Scott, E.C., 1999, Science, religion, and evolution: *in* Scotchmoor, J. and Springer, D.A (eds.), Evolution: investigating the evidence, *Paleontological Society Special Publication 9*, p. 371-380.

VIII. Special resource requirements

There are no special resource requirements for this course.

IX. Bibliography

In addition to the required textbooks and supplemental readings, the following will be used to develop the course curriculum:

Alvarez, L.W., Alvarez, W, Asaro, F. and Michel, H.V., 1980, Extraterrestrial cause for the Cretaceous-Tertiary extinction: *Science*, v. 208, p. 1095-1108.

Bailey, J.B., 1997. Neural spine elongation in dinosaurs: sailbacks or buffalo-backs?: *Journal of Paleontology*, v. 71, no. 6, p. 1124-1146.

Benton, M.J., 1990, Scientific methodologies in collision: the history of the study of the extinction of dinosaurs: *Evolutionary Biology*, v. 24, p. 371-400.

Callaway, J.M. and Nicholls, E.L., (eds.), 1997, Ancient marine reptiles: *Academic Press*, 501p.

Carpenter, K., 2001, The armored dinosaurs: *Indiana University Press*, Bloomington, 512p.

Koeberl, C. and MacLeod, K.G. (eds.), 2002, Catastrophic events and mass extinctions: Impacts and beyond: *Geological Society of America Special Paper 356*, 746p.

Spotila, J.R., O'Connor, M.P., Dodson, P. and Paladino, F.V., 1991, Hot and cold running dinosaurs: body size, metabolism, and migration: *Modern Geology*, v. 16, p. 203-227.

Unwin, D.M. 1996. Pterosaur tracks and the terrestrial ability of pterosaurs: Lethaia, v. 29, no. 4, p. 373-384.

Weishampel, D.E. Dodson, P., and Osmolska, H. (eds.), 2004, The Dinosauria: *University of California Press*, 2nd edition, 880p.

2. SUMMARY OF PROPOSED REVISIONS

1. Objectives – the course objectives were revised slightly from the original syllabus of record and aligned with the Expected Undergraduate Student Learning Outcomes (EUSLO) and Common Learning Objectives found in the criteria for a non-laboratory Natural Science course.
2. Common Learning Objectives for a non-laboratory Natural Science course are met in the content portion of the course. These objectives are:
- examine a body of knowledge of natural science that will contribute to an understanding of the natural world and an appreciation of the impacts that natural sciences have on the lives of individuals and the world in which they live
- understand the differences between science as a knowledge base and science as a process that generates knowledge
- develop an inquiring attitude consistent with the tenets of natural science
- understand the empirical nature of science
- understand the concept of bias and the efforts to which scientists go to avoid it

3. Updated textbook and non-textbook reading to a more current book.
4. Updated the bibliography.

3. JUSTIFICATION/RATIONALE FOR REVISIONS

The course is a currently approved Liberal Studies Non-Laboratory Natural Science course and is being revised to meet the new curriculum criteria for this category.

4. OLD SYLLABUS OF RECORD

See attached sheets.

EXAMPLE ASSIGNMENT: The assignment presented on this and the next two pages is the largest graded exercise assigned for completion to the class. It is a major synthesis exercise that I have the students complete late in the term, after we have covered most of the material included in the course. It requires quite a bit of time outside of class, and some compensatory open lectures are provided accordingly.

A TETRAPOD SCAVENGER HUNT
Synthesis Exercise for GEOS 151

Over the past few years, a number of beautifully crafted replicas of famous fossils have been added to the items on display in Weyandt and Walsh Halls, and (most recently) in the common areas of the Northern Suites next to Weyandt (see map provided as Figure 1 on the last page). Many of these replicas are of extinct tetrapods and this handout provides directions for an assignment to locate many of these replicas, and use their anatomical features to assign them to the appropriate taxonomic groups and/or interpret their lifestyles. Some are dinosaurs; some are not. Successful completion of this exercise will require that you consult your notes from lecture in GEOS 151 and relate the replicas to the material that we have discussed. You may work in groups if you choose, but each student must turn in his or her own set of answers to the questions posed below in a neatly typed text file.

Seven locations are identified by number on the map: 1-3 are on the first floor of Weyandt Hall near the Planetarium (Room 134): 1 is the display case in front of the Planetarium; 2 is what we will call the Weyandt Hall Atrium, the glassed-in area with the ramp and stairwells immediately north of the Planetarium; 3 is the south wall of the Planetarium lobby. Locations 4-6 are on the second floor of Walsh Hall: 4 is the east wall of the small hallway that connects Walsh to Weyandt (across from Dr. Cercone's office in 208 Walsh), 5 is the two display cases on the west side of the main second-floor hallway of Walsh, and 6 is where a large replica is hung on the east wall of that main hallway. Location 7 on the map marks the hallways of the Northern Suites. When asked in any question for the location of a particular replica, you should use these numbers to refer to the appropriate location. There is an eighth location that is not numbered because the piece to which one question refers is a replica of a large theropod footprint, and the objective is for you to search for it and find it. When you give its location, identify the floor of the building and the number of the closest room.

1. Identify, by *genus* name, an ornithischian dinosaur that is on display at one of the numbered locations – and specify the location where it is on display.

2. Identify two locations where replicas of marine reptiles on display, and (for each location) specify which marine reptile group is represented? For one of those replicas, describe what type of locomotion it employed to move through the water, and identify three skeletal features that facilitate such movement.

3. Identify the location and give the *genus* name of the oldest true dinosaur (a "ceratosaur" actually) that is on display.

4. Answer the following questions about the adult "pelycosaur" that is on display at one of the numbered locations.

   a. Give the *genus* of this particular "pelycosaur".

   b. Was this animal a true dinosaur or a "pseudodinosaur"? Back up your conclusions with evidence, i.e., features visible in the skeleton on display.

   c. What type of skull did this extinct tetrapod possess (based on the number and placement of post-orbital openings?)

   d. Was this animal a carnivore or an herbivore? Provide evidence visible in the replica to support your answer.

5. Give the *genus* and the location of the dinosaur replica that is still considered a **carnosaur** (as that dinosaur clade currently is defined – not the old, original carnosaur group that included all the large theropods).

6. Which of the tetrapod replicas hanging on the walls of the hallways in the Northern Suites is a true dinosaur? Identify the floor on which this piece is displayed, give the order (Linnaean grade) to which you would assign this dinosaur, and explain why.

7. At one location, an actual specimen (not a replica) of a dinosaur **trace fossil** is on display. Specify the location, identify what kind of trace fossil it is, and describe the kind of information that can be extracted from such fossils.

8. Give the location, and genus name, of the only trace fossil (different type than the one referred to in question 7) on display that is confidently assigned to a particular dinosaur.

9. Give the numbered location where a replica of part of a **marginocephalian** dinosaur is on display, and also provide the genus name of that dinosaur.

10. Answer the following questions about the replica of a pterosaur that is on display at one of the numbered locations.

a. At which of the numbered locations is this replica on display?

b. Is it a primitive ("rhamphorhyncoid"-type) pterosaur, or a derived ("pterodactyloid") pterosaur? What feature allows you to determine this?

11. There is one other fossil replica available for viewing in Weyandt Hall that is in a less conspicuous location. See if you can find it. It is an impressive large theropod track (footprint), perhaps of a tyrannosaurid. Identify its location by giving the floor and nearest room number.

12. Answer the following questions about the exhibit in the display case in front of the Planetarium (Location 1).

a. Is the display designed to portray the oldest fossils on the left (north), with progressively younger organisms toward the right (south) – or does the age sequence run the opposite direction, proceeding through time from right to left?

b. Explain the paleoclimatic significance of the varied colors of gravel that cover the floor of the display. In particular, why does the color change from black on the left to bright red in the middle?

c. Explain the relationship between the shift in climatic conditions represented by that color change and one of the most significant events in the history of tetrapod evolution. What caused the shift in climate and what impact did it have on the global tetrapod fauna?

13. Of all the tetrapod replicas on display on campus, identify the one that you found most interesting or impressive and explain why it is your personal favorite.

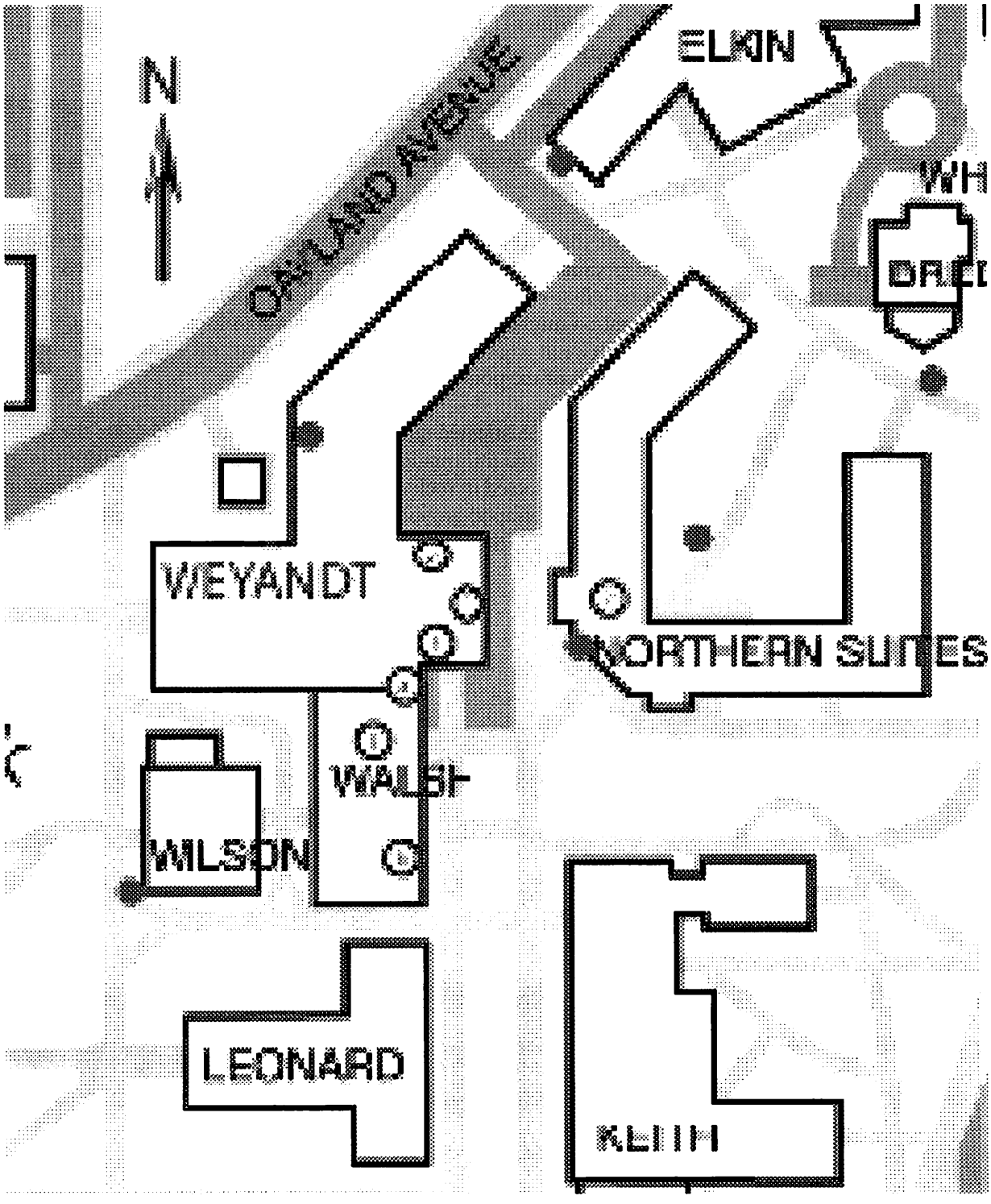

Figure 1: Map of the north end of the IUP campus, showing the four numbered locations where fossil replicas are on display in Weyandt Hall, Walsh Hall, and the Northern Suites.

Grading Criteria for Example Assignment: I do not utilize a rubric in grading the example exercise, but do categorize the constituent questions into three groups.

The first group contains those that are easily graded because they involve return of a basic piece of information that is either right or wrong (numbered location, specific taxonomic group, primitive versus derived form, etc.). Those completely objective questions account for roughly 55% of the points awarded (or not) for this exercise.

The second category includes those that are somewhat more complex because they require students to interpret and integrate the observable characteristics of skeletons on display to arrive at a conclusion regarding lifestyles or habits of extinct creatures (type of locomotion and features that reflect this, what kinds of information might be obtained from such a fossil, etc.). These questions, which I evaluate for consistency between what they put forth as evidence and what they draw in the way of conclusions, accounts for 30% of the points.

The third category comprises the most sophisticated questions that allow me to evaluate the student's insight and ability to synthesize the information and explain complex relationships (e.g. the likely role of changing climate, as reflected in rock characteristics, in bringing about dramatic shifts in relative importance of different tetrapod groups through Earth History). Questions in this third category obviously account for 15% of the total points assigned.

Liberal Studies Course Approval General Information

1. This course will be taught in one section by one instructor.

2. The significant impact made in the field of paleontology by women and minorities throughout the history of our discipline is highlighted in this course through the readings (Eugenie Scott, Judy Scotchmoor, and Dale Springer are all women) and coverage in the lectures of the specific contributions of such luminaries as Mary Anning (of "she sells seashells by the seashore" fame) whose discoveries on the south coast of England in the early 19th century came at a pivotal time in the development of the geological sciences, Helen V. Michel whose geochemical research played a vital role in gaining acceptance in the late 20th century of the unorthodox (but valid) hypothesis of asteroid impact as a cause of the terminal Cretaceous mass extinction, and Gerta Keller, whose persistence in arguing for at least as important a role for volcanism in that extinction based on her study of microfossils from the Gulf Coast region brought us to a better understanding of the complexity of that world-altering crisis. The lead authorship of the now-classic Science paper (Alvarez et al., 1980) by the father-and-son team of Luis and Walter Alvarez that introduced the impact hypothesis (ultimately dubbed the Alvarez Hypothesis) gives credit where it is due to scientists of Hispanic ethnicity.

3. In addition to the textbook, Dinosaurs: a concise natural history, a number of readings are used from non-text sources such as the Scott (1999) article wherein students learn of the false dichotomy of "evolutionist or creationist" and of the fallacy of the incompatibility of science and religion. Students are also directed to a number of essays by Stephen Jay Gould in the series of books assembled as composites of his monthly articles in Natural History magazine (The Panda's Thumb, Bully for Brontosaurus, Hen's Teeth and Horse's Toes) --- different ones in different terms, depending on the direction the course proceeds in response to student input and interest. And certain sections of the marvelous non-text authored by Michael Benton about mass extinctions provide engaging treatment of two events that bracketed the Mesozoic Era, although the focus is on the terminal Permian one.

4. This course differs from the foundational courses for departmental majors (which I taught consistently for over a quarter of a century) in that the students are introduced to what geoscientists do, not trained to be geoscientists themselves. The required level of mastery of content lies far below that required in such courses as GEOS 201 and 202, and the coverage of topics is far less comprehensive. The mathematical rigor of the activities also pales in comparison. The activities are geared toward engendering an appreciation of, and casual familiarity with, the practice of science rather than development of a skill set to be utilized in subsequent upper level courses in the major and a career as a geoscientist or educator. Significant effort is invested in relating the topics to the life experiences, interests, and concerns of those who ultimately will make their living in other fields, outside the sciences.