Geos 170A1 – Earth: From Birth to Death

Exploring Perspectives Natural Scientist; Quantitative Reasoning Attribute

Class meets M,W,F 12-12:50 PM, classroom TBD

The experiences of General Education encourage students to develop a curious and inquiring attitude, an appreciation of interdisciplinary subject areas, acceptance of persons of different backgrounds or values, and a deepened sense of self. We aim to foster critical, innovative thinkers ready to lead cooperatively with interdisciplinary thinking & perspective-taking.

Course Description

In this course, students will learn to apply the perspective of the geoscientist to questions about how and when Earth formed, how it has evolved over time, how those changes are recorded and deciphered in the geologic record, what geological phenomena can tell us about planetary dynamics and geological hazards, how geological processes create change on our planet, and how humans interact with and influence the natural environment. We will put this perspective into practice via the scientific method, using the tools and methodologies of geoscientists, and working with quantitative information in a variety of ways, such as creating and interpreting data sets and graphs.

Instructor and Contact Information

Dr. Jessica Kapp, 324 Gould Simpson, 626-5701, jkapp@email.arizona.edu

"Open Door Policy" when I am in my office. My scheduled office hours are posted on d2l.

Teaching Assistant(s) TBD

All course information is available on our course d2l site, available here:

https://d2l.arizona.edu/d2l/home/984114

Student Learning Outcomes

- **Exploring Perspectives – Natural Scientist Course Learning Outcome:** Students will identify the approaches and methodologies of the Natural Scientist (geoscientist) Perspective, use evidence and/or knowledge generated by geoscientists to critically analyze questions, ideas, and arguments, and describe contributions of the geoscientist perspective to finding solutions for global and/or local challenges.
- **Quantitative Reasoning Attribute Learning Outcome:** Students will demonstrate competency in working with quantitative information by critically analyzing such information, generating ideas that are supported by quantitative evidence, assessing the relevance of data and its associated implications in a variety of contexts, and communicating those ideas and/or associated interpretations using various formats (graphs, data tables, equations, discussions, written reflections).

Course Objectives

In this course, students will:

- Identify the approaches of geoscientists and communicate how they contribute to our understanding of Earth processes.
- Identify contributions of diverse geoscientists and consider their importance in relation to the complexities of our planet.

- Critically analyze important geoscience concepts, such as plate tectonics, using knowledge and evidence generated by geoscientists.
- Apply the perspective of the geoscientist to critically analyze, interpret, and present ideas.
- Consider examples of how geoscientists can help solve challenges such as climate change and depletion of natural resources.
- Discuss the approaches and methodologies that are unique to geoscientists.
- Practice using the tools of the geoscientist to formulate ideas and arguments.
- Construct hypotheses, interpretations, explanations, and arguments from available quantitative geological information.
- Consider quantitative information and use it to describe Earth processes.
- Critically analyze quantitative geoscience evidence and consider its relevance to issues such as climate change, melting of ice caps, natural hazards, etc.
- Communicate quantitative geoscience information using numerical, visual, and graphical representations, and interpret those representations.
- Discuss quantitative geoscience information and evidence in various contexts.

The Student Learning Experience

This course will use a combination of mini-lectures, in-class small group activities including tutorials and think-pair-share exercises, student response technology, and collaborative learning opportunities, to provide students with multiple ways of interacting with and mastering course objectives.

Signature Assignments

Students will complete one signature assignment that will demonstrate their ability to adopt the perspective of the geoscientist while addressing an idea/question/argument/problem. All signature assignments will require students to work in a small group of 2 or 3, with either a numerical data set and/or resulting quantitative information, and to reference the quantitative information in supporting their explanations. The final step will include reflection upon the relevance of the geoscientist perspective in relation to either a local or global challenge, the general progress of science, or their own lives. Signature assignments will become part of students' general education ePortfolios. Groups can choose from one of the following options:

SA Option 1: Find or generate a data set that is relevant to a geological question and create graphs/charts/tables that express that numerical information in a meaningful way. For each visual representation of the data, give a clear and concise interpretation (i.e., what does the data mean). Discuss the relevance of the interpretation in the context of the question chosen. Be sure to include brief discussions of any issues that arose with data collection (either your own or the scientists who collected the data), and uncertainties that were/must be considered. Synthesize an explanation as well as potential alternative explanations and use the data to discuss why one is better than the others. Reflect upon the process of data collection and interpretation, and the explanations that scientists come up with based on this process, both in terms of your own experience as well as in the context of science and/or society.

SA Option 2: Choose a geological change that happens over long time spans (e.g., thousands, millions, or billions of years) and document an example of that change in action. Include numerical and visual representations of that change (e.g., photos, measurements), and organize numerical information in appropriate graphs/tables with brief descriptions of what they show. Describe what is driving that change (processes), and why that change is significant, either in terms of Earth, science in general, or humans and society. Reflect upon what that change tells us about our understanding of time in terms of human time scales as compared to deep time.

SA Option 3: Choose a global/local/societal problem or challenge we face that is related to

geosciences and propose a solution from the perspective of a geoscientist. Outline the problem clearly and provide quantitative information that supports that this challenge is real. Propose approaches a geoscientist might use to solve the problem, being sure to explain why those approaches should work and referencing quantitative information that supports it. Provide examples of the supporting quantitative information expressed in table/graphical form, and brief descriptions of what they show. Reflect on the importance of solving this challenge, in the context of your own experiences and/or in the context of a local or global community.

See next page for complete course schedule.

Course Schedule

Date	Questions	In-class activities	Items due (Note: All work is due on d2l on Sunday nights by 11:59 PM)
Week 1	•What is the Natural Scientist Perspective? •What is unique about the geoscientist perspective?	1. The scientific method – inquiry and observation, and approaches. 2. How field observations inform the geologist perspective (photo analysis).	- Assignment 1: Identify an influential geoscientist and summarize their contribution to the field. - Participation 1, Quiz 1
Week 2	•When did the universe come into being and how do we know? •When and how did the Solar System form? •How was Earth different when it first formed than it is today?	1. Doppler shift and expansion of the universe. 2. Rocky Inner Planets vs. Gaseous Outer Planets. 3. Age dating 4. Density and Earth's layers.	- Assignment 2: Identify one alternative for the age of the Earth, state the hypothesis, and list evidence used in support of that hypothesis. Reflect on whether or not the hypothesis is testable and supported by the majority of quantifiable evidence. - Participation 2, Quiz 2 - ePortfolio: Propose the question or idea you will address for your Signature Assignment
Week 3	•What materials make up the solid Earth? •How are minerals and rocks related? •What are the different ways in which rocks can form and break down? •Why is the rock cycle so important?	1. Rock categories and the rock cycle. 2. Photo analysis of rocks and minerals. 3. Rock Cycle diagram.	- Assignment 3: Choose one of the posted rock photos, state what type of rock you think it is and why. Explain your observations and propose a scenario in which this rock came into existence. - Participation 3, Quiz 3 - ePortfolio: Find a photo of a rock and upload it with a brief description. What rock type is it?
Week 4	•What is the Continental Drift Hypothesis and what evidence supported it? •What was missing from the Continental Drift Hypothesis, and what discoveries led to a better model of Earth dynamics? •What is the Plate Tectonic Theory, and how does it differ from Continental Drift?	1. Continental Drift v. Plate Tectonics. 2. Heat and Density and motion within Earth's Asthenosphere. 3. Outer Layers of Earth.	- Assignment 4: Read the article on Marie Tharp, a female pioneer in geology. List a question she was addressing in her research, describe one method or approach she used to address that question, and explain one of her important findings. - Participation 4, Quiz 4 - ePortfolio: Begin populating with graphs. Describe the basics of each (axes, units, trends)
Week 5	•How do plates move and interact with each other?	1. Tectonic Plates and Boundaries. 2. Seafloor Ages. 3. Divergent Boundary Features.	- Assignment 5: Complete the exercise History of an Ocean. Apply the process of birth and

	•What geologic features and hazards are created by plate tectonic activity? •What is the evidence that plates move and Earth's surface changes over time?	4. Subduction Features. 5. Transform Boundaries.	death of an ocean to The Atlantic Ocean, Pacific Ocean, or the Red Sea, explain what stage of ocean formation it is in and how it is changing. Be sure to describe the evidence that tells you what stage of formation it is in. - Participation 5, Quiz 5
	Midterm 1 – ON d2l		**Midterm 1 due by Sunday night at 11:59 PM**
Week 6	•What causes earthquakes and where do they occur? •Why can't we predict earthquakes? •What do seismic waves tell us about Earth's interior? •How are tsunamis related to earthquakes?	1. Locations of Earthquakes. 2. Earthquake Magnitude and Intensity. 3. The Outer Core. 4. Tsunamis.	- Assignment 6: Generate a graphical representation of earthquake magnitude. Use an appropriate scale on axes. Share with a peer and provide/receive feedback. - Participation 6, Quiz 6 - ePortfolio: Continue population with graphs, add any relevant photos. Revisit graphs and add descriptions. You could use your magnitude graph.
Week 7	•How does heat move between Earth materials, and how does heat affect rocks? •What is magma and what is lava? •Where in the Earth does magma form?	1. Thermodynamic Review. 2. Three Mechanisms of Rock Melting. 3. Magma Source Depth.	- Assignment 7: Choose one of the locations listed on d2l and describe which mechanism of melting is occurring there. Be sure to connect that location to its tectonic setting and predict what type of rocks are being created there as a result of magma/lava cooling. - Participation 7, Quiz 7
Week 8	•Are all volcanoes created the same? •How do we identify different volcano types? •Can we predict volcanic eruptions? •Why are some volcanic eruptions more dangerous than others? •What are hot spots?	1. Volcano Types. 2. Yellowstone – will it erupt soon? 3. Hot Spots 4. Hawaii vs. Chile – which is more dangerous, geologically speaking?	- Assignment 8: Choose one of the videos of volcanic eruptions posted on d2l. Describe the eruption (is it violent or peaceful), the rocks it creates (composition and texture), and predict where on Earth the volcano might be based on volcano type. - Participation 8, Quiz 8 - ePortfolio: Begin gathering data that will be used in Signature Assignment.
Week 9	•What is the water cycle? •How much fresh water do we have on Earth and where is it found? •What causes flooding? •How does groundwater recharge, flow, and discharge?	1. The Water Cycle. 2. The Water Table. 3. Flood Curves. 4. Groundwater flow and Contamination.	- Assignment 9: Use the information posted on d2l to calculate how much water you use on average per day. Post your value to the class spreadsheet in the category you fit in (In-state student, Out-of-state student). Use the collected data to create a graphical representation of average water use among in state vs. out of state students. Is there any trend? Explain. - Participation 9, Quiz 9
Week 10	•What processes influence Earth's surface? •What are the different forms of rock weathering? •What causes a landslide?	1. Weathering. 2. Depositional Environments. 3. Landslides.	- Assignment 10: Choose one of the sedimentary rock layer diagrams posted on d2l. Using the information about thickness of the rock layers, what they are composed of, and the age of the rocks above and below the layers, construct a geologic history. Where did the sediments likely come from (rock type?).

			What was the sedimentation rate assuming it was constant over the given period of time? - Participation 10, Quiz 10 - ePortfolio: Create at least one representation of quantitative information that will contribute to the final product signature assignment.
	Midterm 2 – ON d2l		**Midterm 2 due by Sunday night at 11:59 PM**
Week 11	•How and when did oceans originate on Earth and how do we know? •What drives shallow ocean currents? •What is the Coriolis Effect? •What controls deep ocean currents? •How do oceans relate to the transfer of heat on Earth?	1. Origin of the Oceans. 2. Ocean Surface Circulation. 3. Ocean Layers. 4. The Gulf Stream.	- Assignment 11: Complete the exercise on imagining how heat transfer and local climates could change based on changing ocean current scenarios. - Participation 11, Quiz 11 - ePortfolio: Revise representation of quantitative information. Compare analyses of graphical information with your group. Revisit your plan and adjust as needed.
Week 12	•How did life originate on Earth? •When did life first appear on Earth? •What is the evidence that supports life originating in the early oceans? •What is evolution and how do we know it has happened?	1. Origin of Life. 2. Natural Selection.	- Assignment 12: Read the example of natural selection in the peppered moth population in England during their industrial revolution. Describe how it exemplifies the four postulates of evolution, environmental changes driving evolution, changes in fitness of an organism, and evolution of a population over time. - Participation 12, Quiz 12 - ePortfolio: Draft of signature assignment product. Start bringing all pieces together and get feedback from TA.
Week 13	•What was the origin of Earth's atmosphere and how has it changed over time? •What is the Carbon Cycle? •How does Carbon transfer between Earth's spheres (atmo, hydro, bio, geo)? •Why is carbon so important in terms of climate? •What is the greenhouse effect? •Are the greenhouse effect and global warming related?	1. Origin of the Atmosphere. 2. Layers of the Atmosphere. 3. Simple Atmospheric Circulation. 4. The Carbon Cycle	- Assignment 13: Use the information posted on d2l to figure out how quickly carbon is added to the atmosphere via burning of fossil fuels vs. how quickly carbon is removed from the atmosphere via photosynthesis. Come up with a graphical expression that shows the difference between rates of addition vs. removal of carbon in the atmosphere. - Participation 13, Quiz 13 - ePortfolio: Be sure you have at least one round of feedback from TA and/or Dr. K.
Week 14	•What is the greenhouse effect and how does it work? •What is global warming? •What is the relationship between the greenhouse effect and global warming? •Is the ozone hole directly related to global warming?	1. How Greenhouse Effect Works. 2. Greenhouse Effect and Global Warming. 3. Climate Change and CO2. 4. Greenhouse Effect and the Ozone Hole. 5. Alternative Energy.	- Assignment 14: Look at the Mauna Loa CO2 data set and identify the rate at which CO2 has been increasing over time on average. Discuss the overall trend of the data and what it reflects, as well as the annual fluctuations and what they represent. - Participation 14, Quiz 14

	•How can alternative energy impact the future of climate change?		- ePortfolio: Refine signature assignment, begin reflections (if not already done). Utilize peer feedback.
Week 15	•What is a glacier, and how does the glacier budget work? •How is the glacier budget affected by climate change. •How does ice affect climate? •How does ice tell us something about past climate?	1. Glacier Movement. 2. The Glacier Budget. 3. Albedo. 4. Oxygen Isotopes.	- Assignment 15: Refer to the diagram of the Greenland Ice Sheet posted on d2l. Complete the exercise exploring where on the Greenland ice sheet ice is accumulating, melting, and how ice is flowing on the continent. Propose a scenario in which the Greenland ice sheet would behave differently and explain how it would change. - Participation 15, Quiz 15 - ePortfolio: Collaborate with group to finalize signature assignment. Turn in if complete.
Week 16	•What is the Anthropocene? •How can we mark the beginning of the Anthropocene in the geologic record? •How are humans affecting planet Earth?	1. Natural Resources. 2. The Geologic Time Scale and How We Mark Boundaries. 3. The Anthropocene.	- Assignment 16: Finalize your Signature Assignment. - Participation 16, Quiz 16 - ePortfolio: Signature assignment due.
	Final Exam – ON d2l		**Final Exam is due by Sunday night at 11:59 PM**

Civil Discourse

This course addresses a variety of topics, and course material may include challenging content that asks students to consider different perspectives. General Education courses aim to create an educational environment of inclusion, equity, and mutual respect. Classes (in person and/or online) are safe spaces that support practices such as elective gender pronoun usage and self-identification related to race, gender, (dis)ability, religion, culture, ethnicity, and sexual orientation.

Required Texts or Readings

In this class we require the workbook *Lecture Tutorials for Earth Science by Kortz and Smay (2nd Ed).* This book is available at the UArizona Bookstore, or as an inclusive access eBook on d2l. We will utilize this workbook in almost every class meeting.

Any supplementary readings or activities will be posted on our d2l course site.

Required or Special Materials

Pencils, graph paper, and a ruler will be used in several small group activities.

Absence and Class Participation Policy

Participating in this course is vital to the learning process. As such, attendance is required. Absences may affect a student's final course grade. If you anticipate being absent, are unexpectedly absent, or are unable to participate in class activities, please contact me as soon as possible. *To request a disability-related accommodation to this attendance policy, please contact the Disability Resource Center at (520) 621-3268 or drc-info@email.arizona.edu.* If you are experiencing unexpected barriers to your success in your courses, the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office is located in the Robert L. Nugent Building, room 100, or call 520-621-7057.

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at http://catalog.arizona.edu/policy/class-attendance- participation-and-administrative-drop

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable: http://policy.arizona.edu/human-resources/religious-accommodation-policy.

Absences preapproved by the UA Dean of Students (or dean's designee) will be honored. See http://policy.arizona.edu/employmenthuman-resources/attendance

Makeup Policy for Students Who Register Late

In general, I do not admit students to the class after the first two weeks. If you register late and miss required course work in the first two weeks, I will allow late submission. Please contact me via email as soon as you register to arrange for extended deadlines.

Course Communications

All course announcements and information will be posted on our d2l site. I will also send important updates via your university email. Please check your university email often. The easiest way to reach me is via my university email jkapp@email.arizona.edu. I generally respond within 24 hours.

Schedule/Due Dates

Please see above for a complete class schedule with questions addressed, activities, assignments, quizzes, and exams.

Final Examination or Project

The date and time of the final exam is on the course schedule. Signature assignments will be due in the last week of class. University Final Exam Regulations can be found here, https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information?audience=students&cat1=10&cat2=31, and the University Final Exam Schedule can be found here, http://www.registrar.arizona.edu/schedules/finals.htm

Grading Scale and Policies

Grades are weighted as follows:

Participation	10% of overall grade (three lowest scores drop)
Quizzes	20% of overall grade (three lowest scores drop)
Assignments	20% of overall grade (one lowest score drops)
Exams (open notes)	25% of overall grade
Signature Assignment	25% of overall grade
Total possible	**100%**

Note: To get an A in the class you must earn at least 90%. No exceptions.
Your final grade for the course (3 units) is based on the following grand total scores:

≥90% = A ≥80% = B ≥70% = C ≥60% = D less than 60% = E

All assignments and quizzes will be completed/uploaded via d2l. Students will have one week in which to complete and submit assignments quizzes. Exams will happen on d2l. The signature assignment will be described in the beginning of the semester and students will have the entire semester to work on their signature assignment and submit it no later than the final week of class, with regular updates to myself or the TA required. In general, late work will not be accepted. If you must miss a deadline or

have a medical or other circumstance that interfered with turning in work on time, please contact me as soon as possible. Extensions will be considered on a case-by-case basis. Extra credit will not be given upon request. There will be one extra credit opportunity toward the end of the semester – this will be the only extra credit opportunity.

Requests for incomplete (I) or withdrawal (W)

If you will not be able to complete the work, please drop or withdraw from the class and try again in a future semester. There will be no opportunity for incompletes, or alternatives or make up work after class has ended. I will work with you to find solutions if you have a physical/mental health issue during the semester, but this must happen immediately upon issues arising, not at the end of the semester, to best help you succeed.

Dispute of Grade Policy

Grades are updated regularly on d2l. Students are responsible for checking their grades and raising any concerns about a grade within one week of that grade posting to d2l. Any grade disputes must go through myself, not the TA.

Honors Credit

If you would like to fulfill an honors contract for this class, please contact me to discuss options. Honors contract information can be found here https://www.honors.arizona.edu/honors- contracts.

Bibliography

Current research and/or writings, along with access and availability…

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility to promote civil discourse. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities. Students are asked to refrain from disruptive activities. Students observed engaging in disruptive activities will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave class and may be reported to the Dean of Students.

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. Find information here http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students

Students with Disabilities:

At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let me know so that we can discuss options. You are also encouraged to contact Disability Resources (520) 621-3268 to explore reasonable accommodation. https://drc.arizona.edu/

Other Sources of Help and Information

- The Department of Geosciences main office is room 208 Gould-Simpson, 621-6000.
- The Geosciences Department website is **http://www.geo.arizona.edu.**

Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity.

The University Libraries have some excellent tips for avoiding plagiarism, available at http://new.library.arizona.edu/research/citing/plagiarism.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

Using group chats or other personal communications to send answers is prohibited.

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti- harassment-policy

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students

UA Academic policies and procedures are available at http://catalog.arizona.edu/policies.

Student Assistance and Advocacy information is available at http://deanofstudents.arizona.edu/student-assistance/students/student-assistance

Confidentiality of Student Records http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy- act-1974-ferpa?topic=ferpa

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change, as deemed appropriate by the instructor. Check d2l regularly.

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