Joshua Murray - Education Statement

Philosophy

Earth science lends itself to curiosity. The field allows us to see some of the large-scale processes that shape our world from sea level change to glacial erosion, plate collisions and rifting. The geologic history of a landscape makes one reckon with space and time in ways that other subjects cannot. Through highlighting the natural strength of Earth science I will build courses that prioritise critical thinking and independent understanding.

One natural strength of Earth science is the abundance of unanswered but accessible questions. Plate tectonics was revolutionary in explaining the phenomena we see on Earth, but the theory of plate tectonics is remarkably young and an inquisitive student can meaningfully progress our understanding of our own planet. Many of these outstanding questions are timely and extend from 'pure' science to applications of real societal relevance. With the threat posed by natural hazards and anthropogenic climate change, and the growing demand for critical minerals, our classrooms ought to be filled with passionate students eager to make a difference. I believe that my enthusiasm for the interconnectedness of solid Earth processes, the atmosphere, the ocean, the biosphere, and society allows me to motivate topics in geology to a broad audience.

Field-based teaching provides a further unique advantage to Earth science. When executed well, field trips build independent understanding of class topics by grounding the course's content in observation. The rock record allow one to see backwards in time through nothing other than a hand lens. At a higher level, these trips hone the skill of observation itself. Moments in the field were integral to my learning and I believe in working tirelessly to offer safe but challenging field trips in each of my classes. For some classes, the field trips are short and complementary, for others they are provide the bulk of the learning.

Those principles will crosscut the courses I teach but the content will vary. At Deep Springs I would propose to teach geology courses on *Introduction to Geology*, *Earth's Carbon Cycle and Palaeoclimatology*, *The Practice of Observation*, *Sedimentology*, *Field Geology*, *The Formation and Evolution of Mars*, and *Tectonics*. In addition, if there were interest, I have the requisite experience to teach courses on statistics, graphic design, and computer science. I would relish the opportunity to teach these classes to the next generation of thinkers: for those who stay in science, and for those who take their skills elsewhere.

I learn most by pulling from a variety of subject matter: attending seminars and conference talks outside of my wheelhouse, conversing with academics with whom I have little overlap on paper. I will expect the same from the students I teach, making unexpected connections with colleagues and between fields.

Experience

Here I briefly outline the experiences that have benefited my Earth science teaching.

Analysis of Geologic Data, Spring 2024. I led the follow-up class to Field Geology in which students digitise their field data using GIS software. I then oversaw their process of creating cross sections, stereonets, and writing final reports that describe the evolution of the Muddy Mountains region including deposition, deformation, and erosion.

Field Geology, MIT, January 2024. I organised MIT's month-long field mapping exercise in the Muddy Mountains, Nevada. I coordinated with the BLM for camping; managed all maps and digital tools; and, at times, let instruction. I took groups out daily to give direction as they constructed maps and made observations of a sedimentologically and structurally complex region.

Introduction to Geology, MIT, Fall 2022. This semester marked the return to fully in-person learning. I led labs on rock and mineral identification, isotope geochemistry, tectonics, structural geology, mapping, earthquakes, and river process. I was responsible for the weekend field trip to New York state and western Massachusetts and gave lectures on Weathering and Erosion, and Metamorphic Petrology.

Weatherability Teaching Tool. Outside of my formal instructor rolls, I use my computational skills to build teaching material that I make freely available to the public. This site

allows the user to alter Earth's geologic map and calculate steady-state pCO_2 based upon the balance of volcanic sources and weathering sinks. I presented this to the 2023 Paleoclimate class at MIT and at an NSF-FRES climate-tectonics workshop. I expect other courses to utilize the site this year for interactive lectures on weatherability and climate.

Teaching in Earth Science, MIT, January 2022. I participated in a seminar covering pedagogical concepts and strategies for course design, equitable teaching, feedback, and other topics related to undergraduate level teaching of Earth science. The discussions and readings directly informed my teaching, particularly my awareness of learning styles and how prior knowledge influences a student's experience in a class.

Introduction to Geology, MIT, Fall 2020. I was the teaching assistant for Introduction to Geology during the fully remote COVID-19 year. I took it upon myself to deliver a course that was as authentic as possible. I overhauled the assignments and shipped rocks, minerals, and identification tools to each student, as far as Japan. My work was recognized by the department and I was awarded the EAPS Award for Excellence in Teaching.

Field Geology, MIT, January 2020. I led undergraduates through their mapping of the Piute Mountains, California: a structurally complex area which preserves three phases of metamorphism and folding. I focused on having my group derive tests for their hypotheses of the structural relationships between various rock-types, and modelled patient mapping technique throughout the trip.

Sedimentology, Princeton, Spring 2018. My senior year of my undergraduate degree I was recruited to be the teaching assistant for Sedimentology. I led labs and organized the class trip to Western Australia. The students were divided into research groups answering fundamental questions about carbonate precipitation in Shark Bay. I led the groups' generation of data by drone, total station, differential GPS, and sampling methods. For this work I received the William Bonini '48 Teaching Award.

Structural Geology, Princeton, Fall 2017. I served as a teaching assistant for the Structural Geology field trip to the Orocopia Mountains, California. I guided small groups as they collected structural data and constructed detailed geologic maps. The students appreciated the collaborative nature of our mapping and were keen to continue on in geology.