



PALEONTOLOGY OF THE ALEXANDER ARCHIPELAGO

TBD late April online, May 15 to 26 onsite

Course ID: ARCH 300Y

Academic Credits: 6 Semester Credit Units

FIELD SCHOOL DIRECTOR

Paul C Murphey, PhD



OVERVIEW

Alaska today is commonly associated with spectacular glaciers and cold temperatures, but Alaska's climate has varied over the millennia from tropical to arctic conditions, creating diverse habitats for a variety of land and sea life. The region has a rich fossil record of terrestrial and marine organisms spanning from the Precambrian to the Pleistocene. It is geologically complex, having been episodically inundated with shallow seas, subject to volcanic eruptions and the accretion of oceanic and continental terranes, and witnessing everything from ice ages to tropical climates throughout its long history. Its diverse fossils include ancient stromatolites; beautifully preserved and diverse fossil plants; marine invertebrates such as ammonites, brachiopods, corals, and crabs; diverse vertebrates including fish, ichthyosaurs, dinosaur body fossils and footprints; and ice age mammals such as mammoths, camels, and short-faced bears.

This year's program will explore Alaska's Alexander Archipelago which comprises the southeastern portion of the state, contributing to our understanding of the fossil record and sedimentary geology of this area. The expedition will travel on board the *Endeavour*, a 72-foot US Coast Guard-designated

research vessel with a professional captain and crew. The team will depart Ketchikan late morning on May 15 and arrive in Juneau on May 26.

The Alexander Archipelago is a geologically complex region, containing Paleozoic, Mesozoic, and Cenozoic rock units. From Ketchikan, the expedition will travel to nearby Kasaan Island to examine Devonian marine rocks and fossils, then head west along the top of Prince of Wales Island and through Rocky Pass between Kuiu and Kupreanof Islands. From there we will explore Kuiu Island, the Keku Islands, where we will work in fossiliferous rocks of the Permian Pybus Formation and the Triassic Hyd Group. We will then voyage north along Admiralty Island to Juneau, stopping to work in Paleozoic marine rock units along the way. The expedition will make daily shore excursions, prospecting for new fossil localities and researching the paleontological and geologic history and ancient depositional environments of southeast Alaska's spectacular Alexander Archipelago and the geologically complex Alexander terrane.

Note that this program is limited to 6 students and will take place on board a research vessel, with tight quarters. Students and staff will share space on the ship and students will all share one bunk room for sleeping.

ACADEMIC CREDIT UNITS & TRANSCRIPTS

Credit Units: Attending students will be awarded 6 semester credit through our academic partner, Connecticut College. Connecticut College is a highly ranked liberal arts institution with a deep commitment to undergraduate education. Students will receive a letter grade for attending this field school (see assessment, below). Students are encouraged to discuss the transferability of credit units with faculty and registrars at their home institution prior to attending this field school.

Transcripts: An official copy of transcripts will be mailed to the permanent address listed by students on their online application. One more transcript may be sent to the student's home institution at no cost. Additional transcripts may be ordered at any time through the [National Student Clearinghouse](#).

PREREQUISITES

No previous coursework is required. However, this course will also be beneficial to students who do have previous experience in paleontology, geology, archaeology, and/or natural history in general.

COURSE OBJECTIVES

Our explorations will provide baseline data and fossil specimens that will guide future research efforts. The goal of this field research program is to collect fossils and make observations that will verify and contribute to the accuracy of the geologic maps of the Alexander Archipelago. Our efforts will mostly be focused on beaches which are easily accessible using *Endeavour's* shoreboats and where bedrock exposures are abundant. We will largely be practicing "catch and release paleo," except when discovering exceptionally well preserved or taxonomically rare specimens, in which case we will collect. Our 2025 expedition resulted in the discovery of a rare type of trace fossil called *Radulichnus*, and we will be focused on increasing our sample of this feeding trace fossil for research and publication. Large scale geologic mapping has not been completed for much of the Alexander Archipelago, so the fossils we document will be important for confirming or correcting the ages of the rock units we investigate. We will be utilizing existing fossil locality data provided by the USGS and other agencies/institutions and geologic maps to prospect areas suitable for fossil preservation to verify geologic mapping and

document fossil localities. This information will guide future efforts to explore high potential areas and develop research questions, especially those focused on depositional environments and paleoenvironments of the Alexander Archipelago. The fossil record can be combined with sedimentologic, isotopic, geochronologic, and paleomagnetic data to provide a robust record of past environmental and climatic change as Dr. Murphey and colleagues has engaged in for Eocene rock units in the western United States with funding from the National Science Foundation.

LEARNING OUTCOMES

Students will gain a foundation of geologic and paleontological knowledge along with specific topics suited to the field locations and tasks we will perform during the field research portion of the program.

By the end of the program, students will be able to use the following tools and techniques:

- Understanding the rules of the road: paleontological resource use permits and how these affect our field work
- Reading topographic and geologic maps
- Fossil prospecting
- Fossil locality documentation
- Basic fossil collection and documentation (splitting concretions, surface collection, splitting shale, excavations and quarrying, etc.)
- Use of Abney level, Brunton compass, and Silva compass to determine dip and strike and take bearings
- Measurement of stratigraphic sections and describing sedimentary rocks
- Geologic mapping and data recording using ESRI field maps
- UAS surveys and basic photogrammetry (weather depending)
- Taking field notes and maintaining a field journal
- Basic fossil identification with an emphasis on modern and fossil marine invertebrates and plants
- Identification of modern marine invertebrates of southeast Alaska

ASSESSMENT

Students will be evaluated on their participation in group discussions and activities, as well as performance on assignments, including:

1. Students will record observations, questions and reflections in a field journal, which will be collected and reviewed periodically. This field journal will serve as a record of each student's evolving understanding of paleontology, geology and the natural history of the areas explored.
2. Students will also be expected to clean and prepare curatable fossils for transfer to the Alaska Museum of the North, including providing appropriate documentation, and will be evaluated on their participation. This includes preparing fossil locality data forms for our State of Alaska permit report. During the course, we will also be collecting modern shells and doing census counts at beaches we visit and learning how to identify modern and fossil marine invertebrates.
3. At the conclusion of the expedition, students will submit a scanned copy of their field journal and a copy of their expedition photographs along with a 3 to 5-minute-long self-recorded video describing what they learned during the class and how they believe the knowledge and skills learned will assist with their academic and professional aspirations.

COURSE SCHEDULE

Online Component

During the one-week online portion of the course, students will be expected to complete all readings and attend daily online lectures and discussions. A typical day during the online phase of the program includes 20-40 pages of reading and watching assigned videos, preparation for class discussions, and participating in a 90-minute lecture and discussion online. The assignments and lecture topics will be provided prior to the first day of class. The lectures below may be continued onboard ship if there is insufficient time to complete them during the online sessions:

Day 1:

1. Introduction and Taxonomy
2. Major Groups of Fossil Organisms
3. Fossilization
4. Preservation History of Fossils

Day 2:

1. Species Concepts
2. Naming of Species
3. Historical Geology
4. History of Geology
5. Geologic Time

Day 3:

1. Introduction to Stratigraphy
2. Depositional Environments
3. Paleozoic Life
4. Sedimentary Structures

Day 4:

1. Introduction to Vertebrate Paleo
2. Introduction to the Mesozoic
3. Mesozoic Life
4. Cenozoic Life

Field Research Component

Students will fly to Ketchikan, Alaska and transfer to our research vessel, the *Endeavour*. Activities for the next 11 days will take place on the ship. Important note: Because we are conducting field research, changing conditions, including weather, can dictate our exact schedule. We will follow the following schedule to the extent possible, but we must all be prepared for changes to the itinerary due to weather, unexpected findings, or other conditions. Safety is our primary concern so we must be flexible due to weather, sea conditions, and tides.

May 15

Orientation; safety onboard the research vessel, including shared duties and responsibilities onboard. Students will be assigned to the watch, galley, and deck crews; safety in the field (on a rotating basis, each student will service on each crew twice during the voyage).

Lecture: The expedition route, paleontological permits, Alexander Archipelago geology and paleontology, using aerial imagery and maps to plan for fossil prospecting.

Skills training: Using ESRI field maps to collect data and to visualize geologic mapping and the distribution of fossil localities.

May 16 to 25

Exploring the geology, paleontology, and natural history of the Alexander Archipelago

Our days will begin early in the morning with discussions onboard the Endeavour. We will use observation, maps and aerial imagery to plan our daily activities. Students will receive training and will have the opportunity to practice the use of various tools in the field, including:

- Abney level
- Brunton compass
- Silva compass
- ESRI Field Maps
- UAS surveys and basic photogrammetry
- Grain-size and rock color chart
- Fossil collection techniques and tools (splitting concretions, surface collection, splitting shale, quarries and excavations, etc.)
- Fossil locality documentation

We will use the Endeavour's shore boats to convey us to shore for exploration every day. Students will be expected to document each day's exploration in their field journal. Exact locations for exploration will be determined by our knowledge of Southeast Alaska, geologic maps, fossil locality data, scientific literature, prior surveys, and weather conditions.

Onboard lectures and labs will include:

- Introduction and Welcome: Route, History, Permits, Geology and Paleontology, GIS and Data Collection, Working with Topographic and Geologic Maps
- Lab: Major Groups of Fossils
- Lab: Common Shells of Alaska's Inside Passage, Major Groups of Mesozoic and Cenozoic Marine Invertebrates
- Lab: Modern Alaskan Marine Invertebrates
- UAS photogrammetry
- Example Research Project 1: The Uinta Basin Project
- Example Research Project 2: High Resolution Surface Analysis at Dinosaur Ridge
- Example Research Project 3: The Lost Tracks
- Introduction to Mitigation Paleontology

Note that onboard learning sessions will take place in the evenings on days when we have field work but may take place during the day if we are underway to a new location.

Students will participate in evening discussions on the Endeavour, reflecting on the day's work and relating required readings to our findings. Evening sessions will allow students to present their findings and allow the team to collectively discuss how our explorations can be applied to future work. Additional readings and resources will be available on the vessel.

May 26. Juneau

Our field work concludes with final discussions and a wrap up. Students will be taken to the airport, if desired.

REQUIRED READINGS

PDF files of all mandatory readings will be provided to enrolled students. Students are encouraged to download and/or print readings prior to traveling. Course participants are expected to be prepared to engage the discussions led by the instructor, who will be looking for compelling evidence that students have read and thought about the assigned readings prior to the scheduled day on which they are first discussed.

I. VIDEOS

- A. The Science of Geology:
https://www.youtube.com/watch?v=fgnvKVzZZes&list=PLcl_IGDDt5A65hZDfQVPM EUzD_RYYXWHoy
- B. A Brief History of Geologic Time:
<https://ca.pbslearningmedia.org/resource/history-geologic-eons/history-geologic-eons/>
- C. Historical Geology: https://www.youtube.com/watch?v=zBPypMM_R2M
- D. Plate Tectonics:
https://www.youtube.com/watch?v=z58vSr_VTvk&list=PLcl_IGDDt5A65hZDfQVPM EUzD_RYYXWHoy
- E. Lecture 8 – Sedimentary Rocks, the Archives of Earth History Part I: <https://www.youtube.com/watch?v=6I7oqjD0Cx8>
- F. Geology 20 (Glaciers and Ice Sheets):
<https://www.youtube.com/watch?v=6VkbOSKQP1A>
- G. Glacial depositional environments and stratigraphy (GEO GIRL): <https://www.youtube.com/watch?v=1wroG2YkLRo>
- H. PBS Documentaries (NOVA) (available on Amazon Prime)
 - Episode 1: Ancient Earth: Birth of the Sky
 - Episode 2: Ancient Earth: Frozen
 - Episode 3: Ancient Earth: Life Rising
 - Episode 4: Ancient Earth: Inferno
 - Episode 5: Ancient Earth: Humans
- I. The History of Earth's Moon: How a Disaster Created Life and the Moon: <https://www.youtube.com/watch?v=sSxZuEfsF6c>
- J. A Snowball Earth: How the Ice Age Nearly Wiped Out All of Life: <https://www.youtube.com/watch?v=xhVFZFm44SQ>
- K. The Volcanic Eruption that Wiped Out 95% of Life on Earth:
<https://www.youtube.com/watch?v=gZsz39REQ2Q>
- L. Mesozoic Era – Geologic and Biological Evolution and Extinction of Dinosaurs (GEO GIRL): <https://www.youtube.com/watch?v=uO05x2PHyxk>

- M. How Dinosaur Footprints Survived 65 Million Years:
<https://www.youtube.com/watch?v=S-idnQZNIzE>
- N. The Dinosaur Detectives of Real-Life Jurassic Parks (Martin Lockley – TED): <https://www.youtube.com/watch?v=JSiRpwZbZ7Q>
- O. The Mystery of the Eocene’s Lethal Lake:
<https://www.youtube.com/watch?v=KNvRLVBKn-l>
- P. Paleocene-Eocene Thermal Maximum to Eocene-Oligocene cooling (GEO GIRL): <https://www.youtube.com/watch?v=Eq4Dx-JPBuE>
- Q. Greening of the Earth: Plant Evolution and the Fossil Record with Eric Fuselier: <https://www.youtube.com/watch?v=-RPhN6bVt3U>
- R. Geological maps – Reading layers in a landscape:
https://www.youtube.com/watch?v=rwPSNgX1QJ0&list=PLxvNbEa7Qws68JKh6DA_0h5b-dmM7j6gu
- S. Geo-Files: Reading a geologic map: <https://www.youtube.com/watch?v=91u7BnfgdGc>
- T. Geologic Maps: depicting a 4th dimension:
<https://www.youtube.com/watch?v=DoDPsfMUrxi>
- U. Alaskan Dinosaurs (NOVA)
<https://www.youtube.com/watch?v=JeksnruQKC4>
- V. Geology of Tongass National Forest (USFS)
<https://www.youtube.com/watch?v=b180l4gkqEw>
- W. Southeast Alaska – Introduction
https://www.youtube.com/watch?v=eXO2hhEj4_4
- X. The Complete History of the Earth: The Great Dying (Paleo Analysis) <https://www.youtube.com/watch?v=x7YKfmRrwHo>

II. READINGS (provided to students in PDF format via Blackbaud)

Aaron Baldwin Sealife of SE Alaska. It’s long so I don’t recommend printing it. This is more of a reference. Please just browse through it before the expedition. We will use it as a reference to identify the modern animals we come across on beaches and tide pools. Learning how to identify modern animals and plants is a critical skill and prerequisite to identifying fossils. Many types of modern marine organisms have been around for many millions of years and are commonly found as fossils.

200-Million-Year-Old Swimming Reptile Fossil Discovered in Southeast Alaska. This is a fun read

about the discovery of a new species of Thalattosaur, a primitive type of marine reptile, discovered in the Keku Islands in 2011.

A Coast Beyond Compare: Coastal Geology and Ecology of Southern Alaska. This is an excellent book that describes the coastal geology and ecology of southern Alaska. I have scanned the sections that are relevant to our journey from within the southern portion of the Alexander Archipelago.

Alaska Fossils of the Month – The Siberian Origin of the Alexander Terrane of Southeast Alaska. This article is a concise summary of how marine invertebrate fossils from the Alexander Archipelago have been used to prove that the Alexander terrane is not part of the Laurentian (North American) Craton but originated in Siberia.

An articulated late Triassic (Norian) thalattosauroid from Alaska and the ecomorphology and extinction of Thalattosauria. This article is a more scientifically written report on the same specimen from the Keku Islands described in the article entitled: 200-Million-Year-Old Swimming Reptile Fossil Discovered in Southeast Alaska.

The Late Triassic in the American Southwest: Dawn of the Dinosaurs. This is an excerpt from this great “coffee table” book focused on the Upper Triassic Chinle Formation in Petrified Forest National Park in Arizona. I have included some sections that are pertinent to our class. The idea is to give you an idea of what was happening on land during the deposition of the Triassic marine rocks that we will be exploring.

Dinosaurs on Alaska’s North Slope. This is a fun booklet published by the BLM on Alaska’s north slope dinosaurs. There are no Triassic dinosaurs in Alaska, and the only Jurassic dinosaur fossils are footprints. All Alaskan dinosaur body fossils are Cretaceous in age (and we won't be visiting rocks of this age), but I’m including this in the readings just to give you a flavor of the types of dinosaurs that have been found and it goes nicely with the Dinosaurs of Alaska video I have assigned.

Geology of Southeast Alaska - Rock and Ice in Motion. Please read these excerpts from this book. I have included introductory chapters and portions that are relevant to southeast Alaska. Note that if you haven’t taken any geology classes before, portions of this book are likely to be over your head with terminology, but we will become familiar with the subject matter and geological terminology during the class.

GSA Geology of Alaska Chapter 13: Geology of southeastern Alaska. Like the previous publication, this paper includes a lot of geological terminology. However, at least skim through it and see what you can learn, and we will discuss the paper during our voyage.

A guide to the late Quaternary history of southeast Alaska: Yakutat Block, and Alexander Archipelago. This is a 2008 field trip guidebook published for a “Friends of the Pleistocene” fieldtrip. It is fairly dense geologically, but please skim through it and familiarize yourself with the geography of SE Alaska and the conclusions presented in it.

Marine Reptile Fossils Found on Gravina Island. This is a fun article written by a layperson that describes Triassic Ichthyosaur fossils found on Gravina Island, where we will be going ashore. Pay particular attention to the appearance of the fossil bone and how it contrasts with the rock in which it is preserved.

Sedimentary Rocks in the Field: A Color Guide. This is a fantastic reference to have in the field. I

have a hard copy and will hopefully remember to bring it. Don't bother reading the book but browse through it to get a sense of how it is organized and how we might use it when exploring rock outcrops.

Paleontological Resource Inventory and Monitoring, Southeast Alaska Network. This is a paleo resource report published by NPS. It includes many more geologic formations than those that we will be exploring but is useful because it includes interesting historical information and taxonomic lists of fossils found in different regions and rock units in southeast Alaska. No need to read the entire thing but please skim through and become familiar with the geographic terminology and types of fossils that have been recorded.

I am also giving you access to a PDF called Paleontology of the Alexander Archipelago Shore Excursions. Keep in mind that our route will most likely not include all of these locations and the route may change significantly depending on tides and weather.

Geologic Maps: I have given you access to a bunch of geologic maps of Alaska and specifically southeast Alaska (SEAK) at different scales. All will be available via our ArcGIS online interface onboard the Endeavour. Feel free to download them if you'd like. I used many of them to determine where we will go ashore, but the best for your purposes if you'd like to have one handy on your laptop or tablet is the Alaska State Map (USGS 3340), scale 1:1,584,000. Note that we will be on the eastern sheet, not the western sheet.

EQUIPMENT LIST

1. At least 11" high rubber/PVC boots or similar sturdy footwear.

We recommend 11" high rubber boots from Xtratuf, Grunden or similar (make sure they have a sturdy sole). Hiking boots will get wet and stay wet. Wool hiking socks are a good choice to pair with your boots. Please break the boots in before attending the field study portion of the program. These boots will be worn daily during the expedition, as you will enter and exit the shore boats in shallow water.

2. Waterproof jacket and pants.

Please make sure these are waterproof and not just water repellent. Jackets that have ventilation (such as "pit zips") will allow you to regulate your body temperature better than those without. Jackets should have hoods or bring a rain hat. Look for pants that can tuck into your boots or cinch around them. Rain pants are worn over other pants or long johns. Examples of good rain gear:

<https://www.rei.com/product/227570/rei-co-op-rainier-rain-jacket-mens>

<https://www.rei.com/product/227614/rei-co-op-rainier-rain-jacket-womens>

<https://www.rei.com/product/227615/rei-co-op-rainier-rain-pants-womens>

<https://www.rei.com/product/227731/rei-co-op-rainier-rain-pants-mens>

3. Digital camera with GPS encoding (cell phone with good camera resolution is fine)

4. Rite in the Rain All-Weather Geological Field Notebook

https://www.amazon.com/gp/product/B0011DGJSC/ref=ewc_pr_img_1?smid=ATVPDKIKX0DER&psc=1.

5. A 10X hand lens. Example: <https://www.amazon.com/10x-hand-lens/s?k=10x+hand+lens>