



GEOLOGY 491

Field Paleontology

Summer 2023



General Information

Geology 491 Field Paleontology (GEOL 491 SP TP*) is an intensive two week field course in field paleontology with special emphasis on the Mesozoic and early Cenozoic era fossil deposits of the Bighorn Basin. Through daily hands-on experiences and evening classroom sessions, students will be introduced to various techniques used by field paleontologists in the identification, preservation and removal of fossil remains. Evening sessions will focus on regional geology, stratigraphy, basic vertebrate osteology, and anatomy of the animal groups found in the Basin (especially dinosaurs) and their significance in the rock record. Students will also have the opportunity to plan and lead a small expedition of their own. The course is primarily conducted outdoors and can include both mental and physical challenges routinely associated with field paleontology expeditions. Geology 491 was created through a partnership between Montana State University Billings and the Bighorn Basin Paleontological Institute.

*SP TP = Special Topics

<u>Instructor</u>	<u>Summer Office Location</u>
Dr. Rick Schmidt rschmidt@bbpaleo.org	Yellowstone Bighorn Research Association Howell Gulch Road Red Lodge, MT 59068

Student Learning Outcomes

Upon completion of this course, students will be able to:

- Record and refer to field experiences and findings in a properly detailed field journal
- Know and use proper terminology associated with the tools and techniques used by field paleontologists
- Identify and initiate appropriate field techniques to be used in the collection and removal of paleontological remains including but not limited to, prospecting, sieving, screening, trenching, mapping, and jacketing
- Demonstrate a working knowledge of the paleoecology, stratigraphy, and associated geologic processes that have shaped and continue to shape the Bighorn Basin
- Recognize and assess the numerous safety concerns and hazards that face field paleontologists
- Manage the proper identification and field labeling of paleontological remains
- Interpret paleoecological evidence as preserved in the rock record
- Synthesize a comprehensive paleontological report similar to those produced by field paleontologists when working for outside agencies like the Bureau of Land Management
- Relate regulations pertaining to activities as set forth by the BLM as well as other state and federal agencies including regulations related to the collection, documentation, storage, and study of geologic and fossil specimens collected on federal lands

Assessment

Students' evaluations will be based on a series of performance tasks and their overall participation quality as indicated below. Specific scores follow a specific rubric available to students. All field-based performance tasks will be demonstrated in the first week of the course when students will be offered the opportunity to hone their skills in preparation for week 2 when formal evaluations will occur. Grades will be assigned as follows:

Performance Task 1: Tools and Techniques	05%
Performance Task 2: Mapping	20%
Performance Task 3: Preservation and Jacketing	15%
Performance Task 4: Expedition Planning and Crew Management	20%
Performance Task 5: Expedition Documentation	15%
Performance Task 6: Paleo. Resource Mgmt. Survey Report	15%
Attendance/Professionalism	10%

Performance Tasks

By the end of the course, every student will be responsible for demonstrating proficiency in each of the following field paleontology techniques and skills:

1. ***Tools and Techniques*** - The student will demonstrate proper selection and application of tools in a variety of field situations encountered in field paleontology.
2. ***Mapping*** - The student will demonstrate proper use of topographic, geologic, and aerial (GIS-based) maps in field paleontology. The student will identify an in-situ fossil site and set up an appropriately sized grid for mapping and cataloging the site. The student will create an accurate, scaled sketch/map of a fossil site. The student will also demonstrate proficiency in the use of digital technology used for paleontological mapping. These tasks can be completed as part of a small group at the discretion of the instructor.
3. ***Preservation and Jacketing*** - The student will properly stabilize and then jacket a fossil for later transport from the field site to the lab. This task can be completed in a small group if the size of the fossil warrants.
4. ***Expedition Planning and Crew Management*** - The student will properly plan, deploy, supervise, and manage a small field operation.
5. ***Expedition Documentation and Field Journal*** - The student will keep an accurate field journal detailing all relevant aspects of the field operation. Prior to arriving at the field sites, students should include a section in their field notes reflecting on the required readings.
6. ***Paleontology Resource Management Survey Report*** - The students will produce a comprehensive report on the paleoecology, geology and paleontological resources discovered in an area chosen by the course instructor. This report will be similar in format to those often required by governmental agencies employing field paleontologists.

7. **Attendance/Professionalism** - The student exhibits professionalism in all manner of the expedition both in regard to fossil resources as well as interpersonal interactions. The student attends and participates in all course activities and related events.

Letter Grades

A 100% - 93%	B+ 89.9% -87%	C+ 79.9% -77%	B+ 69.9% -67%	F <60%
A- 92.9%-90%	B 86.9%-83%	C 76.9%-73%	B 66.9%-63%	
	B- 82.9%-80%	C- 72.9%-70%	B- 62.9%-60%	

Class Materials/Required Reading

Class Materials

- Laptop computer
- Gais GPS app for iphone or Android
- Standard personal field equipment (backpack, first aid kit, water container(s), etc.)

Course Website

- geochief.org/geo-491

Required/Recommended Reading (Required are in BOLD)

- Bao, Huiming, Koch, Paul L., Hepple, Robert P. "Hematite and Calcite Coatings on Fossil Vertebrates." *SEPM Journal of Sedimentary Research*, Vol. 68 (1998), 1998, <https://doi.org/10.1306/d426885b-2b26-11d7-8648000102c1865d>.
- Bertog, J, et al. "Taphonomic Patterns of a Dinosaur Accumulation in a Lacustrine Delta System in the Jurassic Morrison Formation, San Rafael Swell, Utah, USA." *Palaeontologia Electronica*, 2014, <https://doi.org/10.26879/372>.
- **Dodson, Peter, et al. "Taphonomy and Paleoecology of the Dinosaur Beds of the Jurassic Morrison Formation." *Paleobiology*, vol. 6, no. 02, 1980, pp. 208–232., <https://doi.org/10.1017/s0094837300025768>.**
- Harris, Jerald D. "The Appendicular Skeleton of *Suuwassea Emilieae* (Sauropoda: Flagellicaudata) from the Upper Jurassic Morrison Formation of Montana (USA)." *Geobios*, vol. 40, no. 4, 2007, pp. 501–522., <https://doi.org/10.1016/j.geobios.2006.02.002>.
- **Harris, Jerald D, and Peter Dodson. "A New Diplodocoid Sauropod Dinosaur from the Upper Jurassic Morrison Formation of Montana, USA." *Acta Palaeontologica Polonica*, vol. 49, no. 2, 2004, pp. 197–210.**
- Myers, Timothy S., and Anthony R. Fiorillo. "Evidence for Gregarious Behavior and Age Segregation in Sauropod Dinosaurs." *Palaeogeography, Palaeoclimatology, Palaeoecology*, vol. 274, no. 1-2, 2009, pp. 96–104., <https://doi.org/10.1016/j.palaeo.2009.01.002>.
- **Myers, T. S., and G. W. Storrs. "Taphonomy of the Mother's Day Quarry, Upper Jurassic Morrison Formation, South-Central Montana, USA." *PALAIOS*, vol. 22, no. 6, 2007, pp. 651–666., <https://doi.org/10.2110/palo.2005.p05-123r>**

- Pol, Diego, et al. “Earliest Evidence of Herd-Living and Age Segregation amongst Dinosaurs.” *Scientific Reports*, vol. 11, no. 1, 2021, <https://doi.org/10.1038/s41598-021-99176-1>.
- **Storrs, Glenn W., et al. “Further Analysis of a Late Jurassic Dinosaur Bone-Bed from the Morrison Formation of Montana, USA, with a Computed Three-Dimensional Reconstruction.” *Earth and Environmental Science Transactions of the Royal Society of Edinburgh*, vol. 103, no. 3-4, 2012, pp. 443–458., <https://doi.org/10.1017/s1755691013000248>.**
- Tschopp, E, et al. “Articulated Bone Sets of Manus and Pedes of Camarasaurus (Sauropoda, Dinosauria).” *Palaeontologia Electronica*, 2015, <https://doi.org/10.26879/559>.
- Zhao, Qi. “Juvenile-Only Clusters and Behaviour of the Early Cretaceous Dinosaur Psittacosaurus.” *Acta Palaeontologica Polonica*, 2013, <https://doi.org/10.4202/app.2012.0128>
- **Dinosaur Anatomy and Orientation** (chart)

Course Policies

Attendance/Professionalism

This is an intensive two week field course and each day will include an average of 8-10 hours of instruction per day either in the field (mornings-afternoons) or in the classroom (evenings). Students are expected to attend all sessions. Depending on the exact location of known (or unknown) fossil sites and summer weather conditions on the basin, *strenuous/prolonged physical activity is a possibility*. Absences due to illness or other extenuating circumstances must be brought to the attention of the instructor immediately.

Professionalism deals with what a student does and how the student contributes while a part of the expedition. Showing up is not always participating and simply talking is not always contributing. Students are expected to participate in a useful manner, work well with others, assist in all facets of the expedition, and handle and preserve the paleontological remains in a responsible way that brings credit to themselves, their home institution, and the organization they represent.

Late Policy

All performance tasks must be completed by the end of the last field day of the course. Due to the unique nature of the course, it is impossible to accommodate tasks that have not been completed within the allotted time of the course with the exception of Performance Task 6 which can be completed after the conclusion of the field experience provided coordination between instructor and students occurs in advance.

Academic Integrity/Misconduct

Montana State University Billings has clear policies on student conduct (both academic and personal) outlined in the Student Policies and Procedures Handbook. Of particular interest to students in GEOL 491 prior to arrival at YBRA are:

- Part IX - Code of Conduct
- Part XII - Academic Misconduct Code

This policy also outlines student rights and due process for disputes. Enrollment as a student in GEO 491 implies agreement to these policies. Students are encouraged to visit <https://www.msubillings.edu/vcsa/studenthandbook.htm> for a detailed description of the academic integrity policies of the university as presented in the *Student Policies and Procedures Handbook*.

In general, all acts of dishonesty in any academically related matter and any knowing or intentional help or attempt to help, or conspiracy to help, another student commit an act of academic dishonesty violates university policies. Academic dishonesty includes, but is not limited to, the following acts when performed in any type of academic or academically related matter, exercise, or activity:

- Cheating-using or attempting to use unauthorized materials, information, study aids, or computer-related information.
- Plagiarism-representing the words, data, works, ideas, computer program or output, or anything not generated in an authorized fashion as one's own.
- Fabrication-presenting as genuine any invented or falsified citation or material.
- Misrepresentation-falsifying, altering, or misstating the contents of documents or other materials related to academic matters, including schedules, prerequisites, and transcripts.

Use of AI for Writing

The use of AI sources like ChatGPT for the writing portion of the course is NOT authorized and will be treated as academic dishonesty.

Students with Disabilities

MSU Billings is committed to providing equal access. If you anticipate barriers related to the format or requirements of this course, please contact with me before the beginning of the course so that we can discuss ways to ensure your full participation in the course. If you determine that disability-related accommodations are necessary, please contact Disability Support Services (657-2283; located in Room 135 in the College of Education). We can then plan how best to coordinate your accommodations.

Sample Schedule*

Day	Morning/Afternoon	Evening
Day 1 (Sunday)	Arrival at YBRA	Presentations: <i>Introduction to YBRA/Safety Briefing</i> <i>Fossil Collecting</i>
Day 2 (Monday)	On Site (Field Site 1): Begin site survey	Presentation: <i>Geology of the Bighorn Basin</i>
Day 3 (Tuesday)	On Site (Field Site 1): Hike of Field Site 1 - geology review Continue site survey	Presentation: <i>Overview of Field Site 2</i>
Day 4 (Wednesday)	On Site (Field Site 2): Begin site survey	Presentation: <i>Paleontology and Fossils</i>
Day 5 (Thursday)	On Site (Field Site 2): Continue site survey	Presentation: <i>Dinosaur Anatomy and Classification</i>
Day 6 (Friday)	On Site (Field Site 1): Continue site survey	Presentation: <i>Expedition Planning and Crew Management</i>
Day 7 (Saturday)	Red Lodge for laundry visitation Presentation: <i>Mapping for Field Operations</i> Mapping Field Exercise	Mapping field exercise
Day 8 (Sunday)	Create Week 2 Operations Order	Create Week 2 Operations Order
Day 9 (Monday)	On Site (Field Site 1): Continue site survey and skills evaluation Prep. for Tuesday field operation	Red Lodge for July 4 th celebration
Day 10 (Tuesday)	Prospecting/survey expedition (site TBA)	Begin Survey Report
Day 11 (Wednesday)	On Site (Field Site 2): Continue site survey and skills evaluation	Continue Survey Report

Day 12 (Thursday)	On Site (Field Site 2): Continue site survey and skills evaluation	Continue Survey Report Beartooth Pass trip
Day 13 (Friday)	On Site (Field Site 1): Continue site survey and complete remaining skills evaluation	Complete Survey Report Class dinner
Day 14 (Saturday)	Depart YBRA	

***This sample schedule is subject to change based on unique conditions and priorities encountered from year to year and should only be used as a guideline.**