EPSc 118a: Geology of National Parks

Spring Semester, 2019

Tuesday-Thursday, 1:00-2:30 PM, Hillman 70

Course Description and Objectives

By observing the landscape around us, we can easily recognize that the Earth is a dynamic planet whose surface landforms and underlying geology are complex. Perhaps the most spectacular and informative displays of this complex geology on our continent can be found within the various units of the U.S. national park system (National Parks; National Monuments; National Seashores, Lakeshores, and Rivers; National Recreation Areas; and National Historic Sites). Both visually exciting and intellectually stimulating, America’s national parks provide a rich framework for the study of basic principles of physical and historical geology. The effects of geologic agents such as volcanism, mountain building, weathering and erosion, sedimentation, glaciation, cave formation, fossilization, river and shoreline processes, etc., are all dramatically illustrated by some segment of the national park system. Moreover — and perhaps of great interest to many of you — the landscape that has developed as a consequence of these diverse geologic processes has had a profound influence on the history and development of the U.S., as we will come to see.

As such, EPSc 118a has been designed to teach students not only aspects of physical and historical geology, but also regional geography and environmental awareness, using national parks as the primary venue for presentation. Students successfully completing this course will be able to:

- appreciate the natural beauty of the landscapes found in national parks;
- recognize visually and on maps, the various geologic features that underlie this beauty;
- explain the origin and geologic history of these features to friends and family;
- relate each national park to the geology of the surrounding region and/or its physiographic province;
- utilize your newly acquired geologic knowledge to make informed decisions about resource management, recreation, zoning, climate change, water and air quality, and related environmental matters affecting the future of the park system and the nation.

To achieve these goals, the course material will be presented in three parts:

1. **Prologue** — The first part of the course will include a brief introduction to the park system, an abbreviated “Grand Tour” of the National Parks, a discussion of geologic time and geologic structures, and a review of modern concepts of global geology, all of this being done to provide a broad context for what follows;
(2) **Geologic Processes** — This second part of the course will review various geologic processes that account for the diversity of landscapes and landforms found within the park system, accompanied by presentations on selected national parks that illustrate these processes;

(3) **Physiography of the US** — In this third and final part of the course, we will embark on a geologic voyage across the U.S., facilitated by in-depth presentations on the geology of selected national park units, beginning at the Atlantic seaboard, heading west across the plains and mountains, and ending up on the Pacific coast. To pique student interest, however, the starting point will be in the southwestern part of the continent, in the region known as the *Colorado Plateau*. The beautifully exposed rocks in national parks throughout the Plateau, predominantly red in color, present some of the most spectacular scenery found anywhere in the US., and provide exceptional insight into geologic time, the nature of rock strata, and ancient geologic environments.

### Course Format, Meeting Times and Places

The course will meet on Tuesday and Thursday in Hillman Hall, Room 70. Lectures will begin promptly at 1:10 PM, in compliance with College policy, and will end at 2:30 PM. Lectures will consist mainly of illustrated talks using slides and, in a couple instances, videotapes that demonstrate important aspects of national parks and their geologic context. A list of lecture topics appears in the accompanying syllabus.

PDF files of lecture slides will be available on ARES prior to each class (except for Class #1). Students are encouraged to down-load these slides beforehand and bring them to class, which will help them follow the lecture. Also, students are encouraged to review the slides and notes after class, and then seek help in understanding matters that may need additional explanation.

### Your Crackerjack Staff

**Instructor**

Robert F. Dymek  
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Office Hours: Tu-Th 3-4  
(or by appointment)

**Graduate TA**

Robert Kuper  
*rkupper @ wustl.edu*  
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(or by appointment)

**Undergraduate TA**

Johnny Worrall  
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Office Hours: TBA  
(or by appointment)

**Undergraduate TA**

Alaina Fierro  
*alainafierro @ wustl.edu*  
Office: TBA  
Office Hours: TBA  
(or by appointment)
**Requirements, Responsibilities, and Expectations**

_There are no prerequisites for this course._ Students will be given the necessary background geologic knowledge through lectures and assigned readings to enable them to grasp the course content. Accordingly, attendance at lectures is essential. It is likewise essential that you do the assigned readings on a timely basis. Reading assignments will be made available on ARES (accessed via the Olin library website), and the readings will be keyed to the lecture numbers as listed on the syllabus. In addition, we plan to post a list of “key concepts” for each lecture on ARES that can serve as a study guide. Exams (see below) will be based on the content of lectures.

The geology of national parks is a wide-ranging subject, and a considerable amount of time and special effort has been expended over the years in acquiring the materials needed to teach this class. Nevertheless, suggestions about ways in which the course can be improved are welcome, and you should be mindful of this as the semester progresses. You should also feel free to ask questions during lecture.

We will attempt to make the course relevant, rigorous, and sometimes entertaining. We will grade tests and homeworks (see below) conscientiously and relatively quickly. We will make ourselves available to you for discussions about the class and/or help sessions during most days, and/or see you by appointment. At the same time, we also have some requests of you. Out of respect for the teaching staff and your fellow students, you will be expected to come to class on time, turn off all cellphones before class begins (no texting during class, please!), and use your computers only for tasks directly related to class activities such as note-taking (not for E-mail, FaceBook, solitaire, ESPN, etc.).

**Grading**

Your performance in this course will be evaluated based on the following:

*Homeworks.* Eight homework assignments will be handed out during the semester (every third class or so). These will be posted on ARES on the days indicated on the syllabus, with due dates and additional instructions provided in each case as warranted. These homeworks will involve essay-style questions pertinent to understanding and extending lecture material, as well as a couple of simple map exercises. Additional outside reading may be required in some cases.

You are free to — if not encouraged to — work in groups to complete the homework assignments. However, what you turn in should reflect your own work and not that of others, and be written in your own words. Accordingly, students should familiarize themselves with the College rules on plagiarism and related matters. We will monitor this situation.

To avoid penalties, homework assignments should be turned in at the beginning of class on the due date specified in each case. Those homeworks turned in a day late will be given half-credit; those turned in later than that will receive no credit. Exceptions will be allowed only in certain rare cases (see below).
Exams. There will be one midterm exam (in class on Thursday, March 7th), and a two-hour final exam (in this room from 1-3 on Tuesday, May 7th). The midterm will cover material presented in lectures up to that point. Most of the final exam will cover material from the remaining lectures. The exams will comprise multiple-choice, fill-in-the-blank, and short-answer questions.

Students must take the exams at the scheduled times except in cases of extreme circumstances (e.g., death in the immediate family, debilitating illness, participation in a varsity athletic event), which must be backed up in writing (e.g., an E-mail or letter from health services or from a coach). Note that the date, time, and place for the Final Exam has been set by the College of Arts & Sciences, and is therefore immutable. Requests to be excused from exams to accommodate flight schedules will not be considered.

One additional point about exams. The instructor is well aware of the fact that a vast amount of material is presented in this course — much of it new to the students. To acknowledge this situation and compensate for it, each student may bring with her or him to the midterm a single-sided 8½ x 11 “crib sheet” containing whatever information deemed necessary to succeed on the test. For the final exam, students may bring a double-sided 8 ½ x 11 “crib sheet.”

Course grades will be computed on the basis of the following algorithm:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Homeworks</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>Mid-term Exam</td>
<td>30%</td>
<td></td>
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<tr>
<td>Final Exam</td>
<td>40%</td>
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</table>

Grades will be assigned on the basis of a modified curve and on overall class performance (i.e., everyone could earn an A, or vice-versa). The last time this course was taught, more than 50% of the students earned grades in the A-B range. For those students taking the class on a pass-fail (or credit/no-credit) basis, a grade of C- (or better) is considered passing. No extra-credit assignments will be accepted.

Grades will be based on the following numerical scale.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>A+</td>
<td>&gt;96.67</td>
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<tr>
<td>A</td>
<td>93.34 – 96.66</td>
<td></td>
</tr>
<tr>
<td>A-</td>
<td>90.00 – 93.33</td>
<td></td>
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<tr>
<td>B+</td>
<td>86.67 – 89.99</td>
<td></td>
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<tr>
<td>B</td>
<td>83.34 – 86.66</td>
<td></td>
</tr>
<tr>
<td>B-</td>
<td>80.00 – 83.33</td>
<td></td>
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<tr>
<td>C+</td>
<td>76.67 – 79.99</td>
<td></td>
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<tr>
<td>C</td>
<td>73.34 – 76.66</td>
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<tr>
<td>C-</td>
<td>70.00 – 73.33</td>
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<tr>
<td>Pass</td>
<td>&gt;70</td>
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<tr>
<td>N.C.</td>
<td>&lt;70</td>
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# Class Schedule

### Part 1: Prologue.

<table>
<thead>
<tr>
<th>Class</th>
<th>Day</th>
<th>Date</th>
<th>Topic</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Tues</td>
<td>Jan 15</td>
<td>Introduction, History of the Park Service</td>
</tr>
<tr>
<td>2.</td>
<td>Thurs</td>
<td>Jan 17</td>
<td>Physiographic Provinces Overview National Parks Grand Tour</td>
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<tr>
<td>3.</td>
<td>Tues</td>
<td>Jan 22</td>
<td>Finish the Grand Tour</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Homework #1 handed out</td>
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<tr>
<td>4.</td>
<td>Thurs</td>
<td>Jan 22</td>
<td>Geologic Time</td>
</tr>
<tr>
<td>5.</td>
<td>Tues</td>
<td>Jan 29</td>
<td>Geologic Structures; Earthquakes and Earth Structure</td>
</tr>
<tr>
<td>6.</td>
<td>Thurs</td>
<td>Jan 31</td>
<td>Continental Drift, Sea-Floor Spreading, Plate Tectonics</td>
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<td>Homework #2 handed out</td>
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</tbody>
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### Part 2: Geologic Processes.

<table>
<thead>
<tr>
<th>Class</th>
<th>Day</th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.</td>
<td>Tues</td>
<td>Feb 5</td>
<td>Igneous Rocks: Overview and Curious Examples</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Devils Tower NM</td>
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<td></td>
<td>• Devils Postpile NM</td>
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<tr>
<td>8.</td>
<td>Thurs</td>
<td>Feb 7</td>
<td>Volcanoes and Volcanic Eruptions</td>
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<td></td>
<td></td>
<td></td>
<td>• Capulin Mountain NM</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Sunset Crater NM</td>
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<td></td>
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<td></td>
<td>• Mt. St. Helens NVM</td>
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<td></td>
<td></td>
<td></td>
<td>• Bandelier NM</td>
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<tr>
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<td></td>
<td>• Newberry NVM</td>
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<tr>
<td>9.</td>
<td>Tues</td>
<td>Feb 12</td>
<td>Hot-Spot Volcanism</td>
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<td></td>
<td>• Hawaiian Volcanoes NP + video</td>
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<tr>
<td>10.</td>
<td>Thurs</td>
<td>Feb 14</td>
<td>Hydrothermal Processes</td>
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<td></td>
<td>• Yellowstone NP + video</td>
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<td>Homework #3 handed out</td>
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<tr>
<td>11.</td>
<td>Tues</td>
<td>Feb 19</td>
<td>Glaciers and Glacial Geology</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>• Alaskan NP</td>
</tr>
</tbody>
</table>
12. Thurs Feb 21 Surf, Ocean Circulation, and Coastlines  
   - National Seashores
13. Tues Feb 26 Groundwater, Karst, and Caves  
   - Mammoth Cave NP  
   - Carlsbad Caverns NP  
   - Wind Cave NP  
   - Jewel Cave NM
   **Homework #4 handed out**
14. Thurs Feb 28 Deserts, Dunes, and Wind Action  
   - Great Sand Dunes NM  
   - White Sands NM
15. Tues Mar 5 Running Water, Erosion, Weathering, and Mass-wasting  
   - Mississippi-Missouri River Basin
16. Thurs Mar 7 **Mid-term Exam**

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**Part 3a: Colorado Plateau.**

17. Tues Mar 19 Colorado Plateau-I: Overview  
   - Petrified Forest NP  
   - Canyon de Chelly NM  
   - Mesa Verde NP
18. Thurs Mar 21 Colorado Plateau-II: Canyonlands Section  
   - Capitol Reef NP  
   - Rivers of the Colorado Plateau  
   - Colorado NM  
   - Black Canyon NP  
   - Arches NP  
   - Canyonlands NP
   - Grand Canyon NP  
   - Zion NP  
   - Bryce Canyon NP
   **Homework #5 handed out**

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### Part 3b: Coast-to-Coast Physiography

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Location</th>
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</thead>
</table>
| 20.  | Thurs | Mar 28 | Coastal Plains and Appalachians Provinces  
- Everglades NP  
- Acadia NP  
- Great Smoky Mountains NP |
| 21.  | Tues  | Apr 2 | Central Lowlands and Superior Uplands Provinces  
- Pipestone NM  
- Voyageurs NP  
- National Lakeshores  
- Great Lakes and Niagara Falls |
| 22.  | Thurs | Apr 4 | Great Plains and Ozark-Ouachita Provinces  
- Badlands NP  
- Theodore Roosevelt NP  
- Palo Duro Canyon SP  
- The Black Hills and Mt. Rushmore  
- Hot Springs NP |
| 23.  | Tues  | Apr 9 | Rocky Mountains  
- Glacier NP  
- Grand Tetons NP  
- Rocky Mountain NP |
| 24.  | Thurs | Apr 11 | Basin and Range Province  
- Valley of Fire SP  
- Chiricahua NM  
- Great Basin NP  
- Organ Pipe Cactus NM  
- Saguaro NP  
- Guadalupe Mountains NP |
| 25.  | Tues  | Apr 16 | Basin & Range, cont’d;  
Columbia Intermontane Province  
- Lake Mead – Salton Trough – Pluvial Lakes  
- Death Valley NP  
- Big Bend NP  
- Craters of the Moon NM  
- Channeled Scablands  
- Columbia River Basin |

**Homework #6 handed out**

**Homework #7 handed out**
26. Thurs Apr 18  Cascades Province
   • North Cascades NP
   • Mt. Rainier NP
   • Crater Lake
   • Lassen Volcanic NP

27. Tues Apr 23  Sierra Nevada Province
   • Yosemite NP
   • King’s Canyon-SEQUOIA NP

28. Thurs Apr 25  Pacific Border
   • Olympic NP
   • Pinnacles NM
   • Joshua Tree NP

**Homework #8 handed out**

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**FINAL EXAM – Tuesday, May 7th, 1-3 PM**

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