

**GEOL 327: Igneous and Metamorphic Petrology (4 credits)  
Spring 2023**

**Lecture:** MW 1-2:15 PM in LFG 102;

**Lab:** Monday 4:00-6:45 PM and Wednesday 8:30-11:15 AM in LFG 202 (or 107)

**Instructor:** Arya Udry

**Office:** LFG 204      **Phone:** (702) 895-1239      **e-mail:** [arya.udry@unlv.edu](mailto:arya.udry@unlv.edu) (email is the best way to contact me, do not rely on the phone)

**Office Hours:** Mon and Wed 2:15-3:15 PM, or by appointment

**Teaching Assistant:** Dalton McCaffrey

**Office:** TEC 108      **email:** [mccafd1@unlv.nevada.edu](mailto:mccafd1@unlv.nevada.edu)

**Required Textbook:** *Principles of Igneous and Metamorphic Petrology (2<sup>nd</sup> Edition)* by John D. Winter (ISBN 13: 978-0-321-59257-6). Every student is expected to do the readings before the relevant lecture.

**Prerequisites:** 220 Mineralogy (C or above)

**Course Description** This upper-level course introduces both igneous and metamorphic petrologic processes, which can be constrained by identifying and classifying igneous and metamorphic rocks.

**Learning Objectives:** At the end of this course, students should be able to:

- Identify, describe, and classify igneous and metamorphic minerals and rocks in hand samples and thin sections
- Interpret magmatic history of rocks using hand sample and microscopic study
- Understand and use various geochemical data and phase diagrams to constrain petrogenesis of igneous rocks and their tectonic context
- Identify and understand metamorphic mineral assemblages to constrain history and P-T conditions
- Discuss the role of igneous and metamorphic processes in the origin and evolution of the Earth's crust and mantle

**Grading policy:** Final grades will be assigned according to the following schedule. The instructor may also elect to curve the **final** grades in the student favor.

<u>Grade</u>	<u>Semester Average</u>	<u>Grade</u>	<u>Semester Average</u>
A	Over 93	C	Between 73 and 77
A-	Between 90 and 93	C-	Between 70 and 73
B+	Between 87 and 90	D+	Between 67 and 70
B	Between 83 and 87	D	Between 63 and 67
B-	Between 80 and 83	D-	Between 60 and 63
C+	Between 77 and 80	F	Less than 60

**Grades:** Grades are based on a combination of in class exams: two covering igneous petrology and one (final) covering metamorphic petrology. The final will include some igneous-related questions but will not be, strictly speaking, a comprehensive exam.

Exam I	15%
Exam II	20%
Exam III (final)	25%
Homework + Field trip	5%
Lab Quizzes and exercises	35%

**Important notes:**

1. You **MUST** pass both the lecture and the laboratory in order to pass the course. A grade of F in lab or a grade of less than 60 in lecture will earn an F for the entire course regardless of the numerical average of the two scores.
2. Required reading means that you are responsible for knowing the assigned material.
3. No extra credit will be given.

**Attendance and Make ups:** On time attendance to class lectures, laboratory, and field trip is required. We will make accommodations for reasonable absences (illness for example), but may require documentation. Please notify us as soon as possible that you will be missing a class and especially a lab or an exam. If you miss a lecture, you are responsible to find out what material was covered and if any schedule changes were announced. If you miss an exam, you must notify me **before the event** with an acceptable excuse with required documentation. Make-up exams must be taken within **one week** of the scheduled test.

**Lab Policies:** Lab assignments are due at the beginning of the following lab period. Labs turned in late will be given partial credit (75%) up to 24hr late. 24–48hr will be graded at 50% and no credit will be given for labs more than 2 days late without a valid excuse. Please let the T.A. know ahead of time if you are going to be missing a lab. If you skip lab or leave more than 15 min early, you forfeit the opportunity to ask questions/seek help during office hours.

**Official Extracurricular Activity:** All students who represent UNLV at any official extracurricular activity have the opportunity to make up an assignment. However, you must provide official written notification to me at least 1 week prior to the missed class(es).

**Non-enrolled guests:** Students are not allowed to bring guests to lecture, laboratory, or the field trip.

**Changes to syllabus:** The lecture schedule is tentative; adjustments to the schedule of topics and readings may be made in accordance with the rate of progress in the classroom. Students will be provided with an updated syllabus if significant changes are necessary.

## Course Schedule

Date	Lecture	Readings Chapter	Lab
Jan 16	<i>No Class – MLK day</i>		<b>MLK Holiday – No lab</b>
Jan 18	Intro to Petrology, Mineralogy review	1	
Jan 23	Igneous structures and field relationships	4	<u>Lab #1</u> : Igneous mineral and microscope review
Jan 25	Classification and textures of igneous rocks	2 + 3	
Jan 30	Chemical petrology – Major + Trace element geochemistry	8 + 9	<u>Lab #2</u> : Igneous rock classification
Feb 1	Isotopes and geochronology I	9.7.2	
Feb 6	Isotopes and geochronology II	9.7.2	<u>Lab #3</u> : Phase diagrams
Feb 8	Thermodynamics + Phase diagrams	5	
Feb 13	Generation of basaltic magmas	10	<u>Lab #4</u> : Chemical variation diagrams and norms
Feb 15	Magma diversity – Differentiation and contamination	11	
Feb 20	<i>No Class – President’s day</i>		<b>President’s day – No lab</b>
Feb 22	Magma diversity II – Differentiation and contamination	11	
Feb 27	Basaltic volcanism at mid-ocean ridges, ophiolites – Review before exam	13	<u>Lab #5</u> : Intro minerals in thin section
<i>Mar 1</i>	<i>Exam I</i>		
Mar 6	Petrogenesis of OIB	14	<u>Lab #6</u> : Ultramafic and Mafic rocks
Mar 8	Subduction I: Island arc volcanism	16	
<i>Mar 13</i>	<i>Spring Break</i>		
<i>Mar 15</i>			
Mar 20	Subduction II: Continental arc volcanism	17	<u>Lab #7</u> : Intermediate and Felsic Rocks + Field trip week
Mar 22	Continental magmatism I	15, 19	
Mar 27	Continental magmatism II	18, 20	<u>Lab #8</u> : Pyroclastic rocks
Mar 29	Introduction to metamorphic rocks (+ metamorphic minerals)	21	
Apr 3	Metamorphic textures – Review before exam	23	<u>Lab #9</u> : Introduction to metamorphic rocks in hand samples
<i>Apr 5</i>	<i>Exam II</i>		
Apr 10	Phase diagrams and Metamorphic reactions	24	<u>Lab #10</u> : Introduction to metamorphic rocks in thin sections
Apr 12	Metamorphic zones and facies	25	
Apr 17	Metamorphism of mafic rocks	25	<u>Lab #11</u> : Metamorphic Phase diagrams
Apr 19	Metamorphism of pelites	28	
Apr 24	Thermobarometry	27	<u>Lab #12</u> : Metapelite rocks
April 26	Calc-silicate rocks and fluids	29	
May 1	Planetary science + Meteorites	X	<u>Lab #13</u> : Metabasic rocks
May 3	Meteorites – Review before exam	X	
<i>May 8</i>	<i>Final exam (1-3 pm)</i>		

**FIELD TRIP: March 25<sup>th</sup>**

**UNLV Policies**

## **Public Health Directives**

Face coverings are currently optional for all faculty and students in the classroom. Students must follow all active UNLV public health directives while enrolled in this class. UNLV public health directives are found at [Health Requirements for Returning to Campus](https://www.unlv.edu/coronavirus/health-requirements), <https://www.unlv.edu/coronavirus/health-requirements>. Students who do not comply with these directives may be asked to leave the classroom. Refusal to follow the guidelines may result in further disciplinary action according to the [UNLV Student Conduct Code](https://www.unlv.edu/sites/default/files/page_files/27/StudentConduct-Code.pdf), [https://www.unlv.edu/sites/default/files/page\\_files/27/StudentConduct-Code.pdf](https://www.unlv.edu/sites/default/files/page_files/27/StudentConduct-Code.pdf), including being administratively withdrawn from the course.

## **Academic Misconduct**

Academic integrity is a legitimate concern for every member of the University community. We all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility, and professionalism. By choosing to join the UNLV community, students accept the expectations of the Student Academic Misconduct Policy, and are encouraged to always take the ethical path whenever faced with choices. Students enrolling at UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's educational mission. An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another person, from the Internet or any other source without proper citation of the source(s). See the [Student Conduct Code](https://www.unlv.edu/studentconduct/student-conduct), <https://www.unlv.edu/studentconduct/student-conduct>.

## **Auditing a Course**

Auditing a course allows a student to continue attending the lectures and/or laboratories and discussion sessions associated with the course, but the student will not earn a grade for any component of the course. Students who audit a course receive the same educational experience as students taking the course for a grade, but will be excused from exams, assessments, and other evaluative measures that serve the primary purpose of assigning a grade.

## **Classroom Conduct**

Students have a responsibility to conduct themselves in class and in the libraries in ways that do not interfere with the rights of other students to learn, or of instructors to teach. Use of devices such as cellular phones and pagers, or other potentially disruptive activities are only permitted with the prior explicit consent of the instructor.

Students are specifically prohibited to record classes without instructor authorization, including online/remote classes (either audio only, or video and audio). The instructor may rescind permission at any time during the class. If a student does not comply with established requirements or obstructs the functioning of the class, the instructor may initiate an administrative withdrawal of the student from the course.

Since the COVID-19 pandemic forced some instruction to be delivered remotely starting in Spring 2020, numerous students have asked instructors to record their synchronous classes, so that they can access them at their convenience. Instructors who agree to record their classes (audio only, or video and audio) should inform students in advance. Recorded lectures may

not be broadly released to anyone, but made available exclusively to those students enrolled in the class during the particular academic term. Recorded lectures must be stored securely, and are subject to the Nevada System of Higher Education's Records Retention Policy, meaning that the recordings can only be deleted 120 days after the end of class (i.e., after grades are posted). Once this requirement is met, the recordings should be deleted. Class recordings are protected from disclosure, as they are deemed part of an educational record under the Family Educational Rights and Privacy Act (FERPA).

### **Copyright**

The University requires all members of the University Community to familiarize themselves with and follow copyright and fair use requirements. You are individually and solely responsible for violations of copyright and fair use laws. The University will neither protect nor defend you, nor assume any responsibility for student or employee violations of fair use laws. Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. Additional [copyright policy information](https://www.unlv.edu/provost/copyright) is available at <https://www.unlv.edu/provost/copyright>.

### **Disability Resource Center (DRC)**

The [UNLV Disability Resource Center](https://www.unlv.edu/drc) (Campus Resource Center (CRC), across Harmon from the Lied Library, <https://www.unlv.edu/drc>, telephone 702-895-0866) provides resources for students with disabilities. Students who believe that they may need academic accommodations due to a permanent disability, temporary or permanent medical need, or academic support due to pregnancy are encouraged to contact the DRC as early as possible in the academic term. A Disabilities Specialist will discuss what options may be available to you. Students who are already registered with the DRC should request their accommodations online each semester, and make an appointment to discuss their accommodations with their instructors.

### **Final Examinations and Study Week**

The University requires that final exams given at the end of a course occur on the date and at the time specified in the Final Exam schedule. The general schedule is typically available at the start of the semester, and the classroom locations are available approximately one month before the end of the semester. See the [Final Exam Schedule](https://www.unlv.edu/registrar/calendars), <https://www.unlv.edu/registrar/calendars>.

### **Identity Verification and Online Course Requirements**

All UNLV students must use their Campus-issued ACE ID and password to log in to WebCampus-Canvas.

UNLV students enrolled in online or hybrid courses are expected to read and adhere to the [Student Academic Misconduct Policy](https://www.unlv.edu/studentconduct/misconduct/policy), <https://www.unlv.edu/studentconduct/misconduct/policy>, which states that “acting or attempting to act as a substitute for another, or using or attempting to use a substitute, in any academic evaluation or assignment” is a form of academic misconduct. Intentionally sharing ACE login credentials with another person may be considered an attempt to use a substitute,

and could result in investigation and sanctions, as outlined in the Student Academic Misconduct Policy. UNLV students enrolled in online courses are also expected to read and adhere to the Acceptable Use of Computing and Information Technology Resources Policy, <https://www.it.unlv.edu/policies/acceptable-use-computing-and-information-technology-resources-policy>, which prohibits sharing university accounts with other persons without authorization. To the greatest extent possible, all graded assignments and assessments in UNLV online courses should be hosted in WebCampus-Canvas or another UNLV-managed platform that requires ACE login credentials for access.

### **Incomplete Grades**

The grade of “I” (Incomplete) may be granted when a student has satisfactorily completed three-fourths of course work for that semester/session, but cannot complete the last part of the course for reason(s) beyond the student’s control and acceptable to the instructor, and the instructor believes that the student can finish the course without repeating it. For undergraduate courses, the incomplete work must be made up before the end of the following regular semester. Graduate students receiving “I” grades in 500-, 600-, or 700-level courses have up to one calendar year to complete the work, at the discretion of the instructor. If course requirements are not completed within the period indicated, a grade of “F” will be recorded, and the student’s GPA will be adjusted accordingly. Students who are fulfilling an Incomplete grade do not register for the course, but make individual arrangements with the instructor who assigned the “I” grade.

### **Library Resources**

Librarians are available to consult with students on research needs, including developing research topics, finding information, and evaluating sources. To make an appointment with a subject expert for this class, please visit the Libraries’ Research Consultation website, <https://guides.library.unlv.edu/appointments/librarian>. You can also ask the library staff questions via chat and text message at <https://ask.library.unlv.edu/>.

### **Missed Classwork**

Any student missing class, quizzes, examinations, or any other class or laboratory work because of observance of religious holidays will be given an opportunity during that semester to make up the missed work. The make-up opportunity will apply to the religious holiday absence only. It is the responsibility of the student to notify the instructor within the first 14 calendar days of the course for Fall and Spring courses (except for modular courses), or within the first 7 calendar days of the course for Summer and modular courses, of their intention to participate in religious holidays which do not fall on state holidays or periods of class recess. For additional information, please visit the Missed Classwork policy, under Registration Policies, on the Academic Policies webpage, <https://catalog.unlv.edu/content.php?catoid=39&navoid=10666>.

In accordance with the policy approved by the Faculty Senate regarding missed class time and assignments, students who represent UNLV in any official extracurricular activity will also have the opportunity to make up assignments, provided that the student submits official written notification to the instructor no less than one week prior to the missed class(es).

The spirit and intent of the policy for missed classwork is to offer fair and equitable assessment opportunities to all students, including those representing the University in extracurricular activities. Instructors should consider, for example, that in courses which offer a “Drop one” option for the lowest assignment, quiz, or exam, assigning the student a grade of zero for an excused absence for extracurricular activity is both contrary to the intent of the Faculty Senate’s policy, and an infringement on the student’s right to complete all work for the course.

This policy will not apply in the event that completing the assignment or administering the examination at an alternate time would impose an undue hardship on the instructor or the University that could be reasonably avoided. There should be a good faith effort by both the instructor and the student to agree to a reasonable resolution. When disagreements regarding this policy arise, decisions can be appealed to the Department Chair/School Director, College/School Dean, and/or the Faculty Senate Academic Standards Committee.

For purposes of definition, extracurricular activities may include, but are not limited to academic recruitment activities, competitive intercollegiate athletics, fine arts activities, liberal arts competitions, science and engineering competitions, and any other event or activity sanctioned by a College/School Dean, and/or by the Executive Vice President and Provost.

### **Rebelmail**

Rebelmail is UNLV’s official email system for students and by University policy, instructors and staff should only send emails to students’ Rebelmail accounts. Rebelmail is one of the primary ways in which students receive official University communications, information about deadlines, major Campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the University. Sending emails within WebCampus-Canvas is also acceptable.

### **Title IX**

UNLV is committed to providing an environment free of all forms of unlawful discrimination including sexual and gender-based discrimination, harassment, and violence like sexual assault, intimate partner violence, and stalking. If you, or someone you know, has experienced or is experiencing these types of behaviors, know that you are not alone. Resources and support are available. To learn more or to report an incident, please visit the Office of Equal Employment and Title IX website at <https://www.unlv.edu/compliance>. Please be aware that as an instructor, I am not a confidential resource, and I will need to report incidents of sexual misconduct to UNLV’s Title IX Coordinator. You can also report concerns directly using the online reporting form, at [https://cm.maxient.com/reportingform.php?UnivofNevadaLasVegas&layout\\_id=18](https://cm.maxient.com/reportingform.php?UnivofNevadaLasVegas&layout_id=18), or via email at [titleixcoordinator@unlv.edu](mailto:titleixcoordinator@unlv.edu) or 702-895-4055. For confidential support in matters of sexual violence, relationship/family violence, or stalking, contact the Care Center at <https://www.unlv.edu/carecenter> or 702-895- 0602.

### **Tutoring and Coaching**

The Academic Success Center (ASC), at the Claude I. Howard Building, provides tutoring, academic success coaching, and other academic assistance for all UNLV undergraduate students. For information regarding tutoring subjects, tutoring times, and other ASC programs and services, please visit the ASC website, <https://www.unlv.edu/asc>, or call 702-895-3177. The ASC is located across from the Student Services Complex (SSC). Academic success coaching is located on the second floor of SSC A, Room 254. Drop-in tutoring is located on the second floor of the Lied Library, and on the second floor of the College of Engineering building (TBE A 207).

### **UNLV Writing Center**

One-on-one or small group assistance with writing is available free of charge to UNLV students at the

Writing Center, <https://writingcenter.unlv.edu/>, located in the Central Desert Complex, Building 3, Room 301 (CDC 3–301). Walk-in consultations are sometimes available, but students with appointments receive priority assistance. Students may make appointments in person or by calling the Center, telephone 702-895-3908. Students are requested to bring to their appointments their Rebel ID Card, a copy of the instructions for their assignment, and two copies of any writing they have completed on their assignment.

### **988 FREE 24/7 SUICIDE & CRISIS LIFELINE**

In addition to campus resources such as the Counseling and Psychological Services (CAPS) website at <https://www.unlv.edu/caps>, visiting the YOU@UNLV website at <https://you.unlv.edu/>, and Early Alert (for graduate students, at <https://www.unlv.edu/graduatecollege/academy/early-alert>), you may now call or text 988 or chat at 988lifeline.org if you or someone you know is in crisis and in need of support.

### **Diversity Statement**

As an institution of higher learning, UNLV represents a rich diversity of human beings among its faculty, staff, and students, and is committed to cultivating a campus environment that values diversity, practices inclusion, and actively promotes equitable experiences and outcomes. Accordingly, the University supports understanding and appreciation of all members of its community, regardless of race, sex, age, color, national origin, ethnicity, creed, religion, disability, sexual orientation, gender, gender identity, marital status, pregnancy, genetic information, veteran status, or political affiliation. Please see University Statements and Compliance, <https://www.unlv.edu/about/statements-compliance>.

A successful learning experience requires mutual respect and trust between the students and the instructor. Accordingly, the instructor asks that students be willing to listen to one another's points of view, acknowledging that there may be disagreements, keep discussion and comments on topic, and use first person, positive language when expressing their perspectives.



**UNLV Land Acknowledgement**

UNLV is situated on the traditional homelands of Indigenous groups, including the Nuwu or Nuwuvi, Southern Paiute People, descendants of the Tudinu, or Desert People. We honor and offer gratitude for those who have stewarded the land; for the land itself; and for the opportunity to cultivate a thriving, diverse, inclusive, and just scholarly community here today that works for a better tomorrow for all.