GEO 4520- MARS FIELD GEOLOGY

JUNE 1-17, 2020

2 CREDIT HOURS

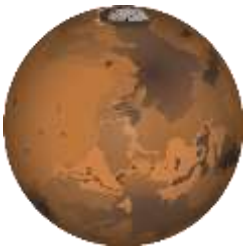

Image: Wikipedia

COURSE DESCRIPTION: Builds on skills acquired in Field Geology Part 1 with geologic mapping in geologically more complex terrains and quantitative analysis of 3-dimensional field data. The mapping exercise utilizes authentic imagery and data collected by Mars exploration missions and culminates in the creation of a geologic map, cross-section, and stratigraphic column from a Martian field site, and in the preparation of a professional technical report.

INSTRUCTORS:

Casey Duncan, Zoom office hours: T/Th 2-4pm

Prof. David Dinter, Zoom office hours: T/Th 2-4pm

LEARNING OUTCOMES: It is hoped that by participation in this course, you will increase abilities and confidence in the following:

- Apply existing/further refine knowledge and **geologic reasoning** to describe, differentiate, and map units, in order to interpret the geologic history of a complex field area on Mars.
- Collect accurate and sufficient **data** of varied types, then analyze and synthesize **data** across multiple spatial and temporal **scales** to produce hypotheses and interpretations of Earth (and Mars) systems.
- Understand and visualize **geometries and relationships** between structures, contacts, map units, etc. to decipher the geologic history of the field area.
- Evaluate observations/evidence to develop consistent **hypotheses** and make decisions in a spatial framework in which to test them and recommend **exploration targets for Mars 2020**.
- Read, understand, critique, and synthesize published **peer-reviewed literature**.
- Learn to prepare **professional written reports** to summarize/synthesize observations/data products and to clearly communicate major findings and interpretations.

Additional capstone field course learning outcomes upon which this course is based can be found here: https://nagt.org/nagt/teaching_resources/field/designing_remote_field_experie.html

COURSE LOGISTICS

JEZERO CRATER MAP AND REPORT: For this module, we will map and interpret Jezero crater, Mars! Jezero crater is the landing site for the Mars 2020 Perseverance Rover that is scheduled to launch this summer. Perseverance will land on February 18, 2021 to investigate lacustrine and deltaic rocks for a mission scheduled to last at least one Mars year (~687 Earth days). While we map and explore Jezero crater for this project, Perseverance will be undergoing final preparations for launch, meaning that we will get the opportunity to learn about Jezero, make predictions of what the rover might find, then actually see if those predictions pan out! For this project, you will need:

- Access to internet for Canvas, Zoom/Skype, and searching for Mars data and references as needed.
- Access to CMES virtual computing resources or Install JMARS (it's free, and no account is required): https://jmars.mars.asu.edu/
- Microsoft Office or OpenOffice

You will work through four modules during this course. Each is designed to introduce you to the necessary software and methods to produce the different products that will go into your final report. In the end, you will produce the following key components:

1. Jezero Crater Map
2. Stratigraphic Column
3. Jezero Crater Cross Section
4. Table of Map Units, including:
    a. Map unit descriptions
    b. Unit orientations
    c. Key cross-cutting relationships
    d. Crater count "age" data, if applicable
    e. Unit compositional attributes

These components form the basis for a final report (your OWN individual write up) wherein you will summarize the geologic history of Jezero crater and make recommendations for possible rover exploration targets.

MAP CHECK: On Monday June 8, we will hold zoom map checks, akin to how we would check progress in a normal field course. For these map checks you will sign up as a group for a 20 min time slot to meet online with the instructors to check your geologic map progress.

GRADING PROCEDURES: Grades will be determined based on module deliverables (40%), the final report and key components (50%), and professionalism/participation (10%). Point grades for each component (the key components listed above) will be assigned based on formal rubrics. Final letter grades for the course will be assigned based on the 100-point scale as follows (some flexibility in cutoffs may be allowed, if warranted):

A: 90-100
B: 80-90
C: 70-80

D: 60-70
E: <60

COURSE EXPECTATIONS: While you will work in groups, you are expected to do your own original work and your own write-ups. Discussions with mapping partners is encouraged and expected to produce accurate geologic maps and interpretations, plagiarism and copying will not be tolerated. In addition, it is expected that you will spend 20-30 hours per week on this course. This course will use authentic data and readings from the literature to fulfill the desired learning outcomes. The readings will provide necessary background information and they serve as examples for writing the final report. While reading, understanding, and synthesizing a variety of papers can be challenging, and we will incorporate a good number of papers, the skill of reading and synthesizing literature will serve you well in whatever field you wish to pursue. For help with understanding and critiquing a scientific paper see these helpful resources: https://twp.duke.edu/sites/twp.duke.edu/files/file-attachments/scientific-article-review.original.pdf or https://www.iflscience.com/technology/how-read-and-understand-scientific-paper-guide-non-scientists/.

Note: Due to COVID-19, there are no in-person meetings, and all lectures and instructor interactions will be online.

CLASS SCHEDULE:

This course utilizes blended asynchronous activities with synchronous live online lectures and team collaboration. There will be 5 live online Zoom lectures:

Mon	**June 1 10-11 am**	**Introduction to Mars**
Wed	**June 3 10-11 am**	**Planetary Mapping**
Mon	**June 8 10-11 am**	**Compositional Remote Sensing**
Wed	**June 10 10-11 am**	**Telling Time on Other Planets**
Fri	**June 12 10-10:30 am**	**Guest Speaker**

All lectures will be recorded and posted to Canvas in the event that you miss a lecture. Additional group discussion with your team will be up to you to work out and schedule.

Day	Topics	Assignments
Week 1: Introduction to Mars, Field Mapping		
6/1	**Lecture 1: Course logistics, Intro to Mars**	Background reading
6/2	Module 1: Intro to JMARS	JMARS export of context figure/Jezero regional figure (map area) **Due 6/3/2020 10am**
6/3	**Lecture 2: Planetary Mapping** Module 2a: Jezero Crater Map- Map Units	Table of Jezero map unit descriptions **Due 6/4/2020 10am**
6/4	Module 2b: Jezero Crater Map- Unit Contacts	Module **Due 6/5/2020 10am**

6/5	Module 2c: Jezero Crater Map- Unit Orientations	Stereonet plots of unit orientations **Due 6/8/2020 10am**
Week 2: Field Mapping, Adding Chronology and Composition		
6/8	**Lecture 3: Compositional Remote Sensing** Wrap-up Modules 2a-c	**Map check: rough draft of Jezero crater map**
6/9	Module 3: Compositional Remote Sensing	Add compositional data to unit attribute table, spectral plots **Due 6/10/2020 10am**
6/10	**Lecture 4: Telling Time on Other Planets** Module 4: Crater Counting	Crater count excel file & plots, add age data to unit attribute table **Due 6/11/2020 10am**
6/11	Report writing	-
6/12	**Guest Speaker** Report writing	-
Week 3: Finalize Report		
6/15	Report writing	-
6/16	Report writing	-
6/17	Report writing	**Final report due via Canvas by 5pm.**

***Activities in bold are required.

COURSE ENVIRONMENT

PROFESSIONALISM STANDARDS: Your enrollment in this class binds you to the ethics policy outlined in the University Student Code: http://regulations.utah.edu/academics/6-400.php

All those involved in this course will also be expected to act in accordance with the Department of Geology and Geophysics Professional Ethics Policy: https://earth.utah.edu/_resources/documents/FINAL%20GEO%20Professional%20Ethics%20Policy%202018-05-03.pdf

THE AMERICANS WITH DISABILITIES ACT: The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the Center for Disability Services (CDS), 162 Olpin Union Building, 801-581-5020. CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to the CDS.

ADDRESSING SEXUAL MISCONDUCT: Title IX makes it clear that violence and harassment based on sex and gender (which Includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against

other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801- 585-2677(COPS).

CAMPUS SAFETY: The University of Utah values the safety of all campus community members. To report suspicious activity, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and training resources, including helpful videos, visit safeu.utah.edu.

INCLUSIVITY STATEMENT: It is our intent that students from all diverse backgrounds and perspectives be well-served by this course. Student learning needs will be addressed both in and out of class, and student diversity is viewed as a resource, strength and benefit. It is our intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let us know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let us know so that we can make arrangements for you.

WELLNESS STATEMENT: Personal concerns such as stress, anxiety, relationship difficulties, depression, cross-cultural differences, etc., can interfere with a student's ability to succeed and thrive at the University of Utah. For helpful resources contact the Center for Student Wellness at www.wellness.utah.edu or 801-581-7776.

INFORMATION AND RESOURCES FOR STUDENTS:

Resources available for information and services available to students:

1. For University policies, guidelines, and restrictions concerning coronavirus on campus: https://coronavirus.utah.edu/
2. Feed U Pantry: https://union.utah.edu/resources-spaces/feed-u-pantry/
3. The Mindfulness Center: https://mindfulnesscenter.utah.edu/
4. University Counseling Center: https://counselingcenter.utah.edu/
5. University Writing Center: https://writingcenter.utah.edu/

In addition, the Academic Advising Center has compiled links to numerous resources available through the university: https://advising.utah.edu/student-resources.php