Geology 422/622 and 423/623 —Petrology 2024
North Dakota State University
Syllabus version Mar 21, 2024 - Subject to change

Time:	Lecture: Tuesday and Thursday, 12:30 – 1:45 p.m. Lab: Wednesday, 12:00 – 1:50 p.m.
Location:	Sugihara Hall 148 – Microscopy Lab in Sugihara Hall 262
Instructor:	B. Saini-Eidukat, office 208 Sugihara Hall, ext. 1-8785 email: bernhardt.sainieiduk@ndsu.edu
Student visit hours:	Tuesdays, 2:00 - 4:00 p.m. at my office or in Sugihara 262
Texts:	required: Winter, J.D., 2010, "Igneous and Metamorphic Petrology," 2nd ed. www.whitman.edu/geology/winter/ required: D. Perkins & K. Henke, Minerals in Thin Section, 2nd ed., Prentice. Supplemental (not required): Ehlers, E.G., 1987, Optical Mineralogy, Vol. 1: Theory and Techniques, Vol. 2. Mineral Descriptions. Raith et al., 2012, Guide to Thin Section Microscopy, http://www.minsocam.org/msa/openaccess_publications/#Guide Supplemental (not required): "Igneous Petrology" by McBirney, 2nd ed.; "An Introduction to Metamorphic Petrology" by Yardley; also Wilson (1989); Philpotts; Klein and Dutrow.
Web Site:	www.ndsu.edu/pubweb/~sainieid/pet/

Lecture: This course is an introduction to Earth's igneous and metamorphic rocks. The prerequisite is a course in mineralogy. We will investigate how these rocks were formed, their geochemical and mineralogical characteristics, and how to interpret them to understand their genesis. We will learn from a combination of lectures, in-class exercises and discussion, homework, and a hands-on term project.
Lab: This laboratory course is an introduction to the theory and practice of optical microscopy; classification and identification of igneous and metamorphic rocks in hand specimen and thin section; and interpretation of rock textures and mineral assemblages.

Lecture, Lab and Exam Schedule; Readings

			Chapter
T	9 Jan	Earth composition and structure; Igneous rock classification	Winter 1,2
W	10	**Lab 1** – Optical properties of isotropic and uniaxial minerals	Lab Manual
Th	11	Optical petrography - theory and practice	Lab Manual
T	16	Optical petrography - theory and practice	Lab Manual
W	17	**Lab 2** – Optical properties of biaxial minerals	Lab Manual
Th	18	Intro to thermodynamics; One-component systems	Winter 5 & 6
T	23	**Lab 3** – Feldspars, feldspathoids	Lab Manual
W	24	**No Class**	
Th	25	Two-component systems; Partial melting	Winter 6
T	30	Two- and three-component systems	Winter 6 & 7
W	31	**Lab 4** – Mafic and ultramafic Rocks	
Th	1 Feb	Three-component systems	Winter 7
T	6	Three-component systems	Winter 7
W	7	**Lab 5** – Major and minor element chemistry of igneous rocks	Winter 8
Th	8	Major and minor element chemistry	Winter 8
T	13	Major and minor element chemistry	Winter 8
W	14	**Lab 6** – Volcanic rocks – SEM Lab tour	
Th	15	Lecture **Exam 1**	(covers Winter 1,2 4-8)
T	20	Mantle stratigraphy, magma generation, diversification	Winter 10, 11
W	21	**Lab 7** – Granitoids	
Th	22	Mantle stratigraphy, magma generation, diversification	Winter 10, 11
T	27	Trace element chemistry	Winter 9
W	28	**Lab – Exam 1**	(covers Labs 1 - 4)
Th	29	Trace element chemistry	Winter 9
T	5 Mar	Spring Break	
W	6	Spring Break	
Th	7	Spring Break	
T	12	Trace element chemistry (isotopes)	Winter 9
W	13	Project Work	Winter 9

Th	14 Mar	Trace element chemistry (isotopes)	Winter 9
T	19	Mafic volcanism	portions of Winter 12, 13, 14, 15
W	20	**Lab 8** – Metapelites; Metamorphic textures	Winter 23
Th	21	MORB and Continental Rifting	portions of Winter 10, 13, 15
T	26	Subduction-related volcanism	portions of Winter 16, 17, 18, 19
W	27	**Lab 9** – Contact metamorphic rocks	
Th	28	Metamorphic assemblages and phase equilibria	Winter 24, 25
T	2 Apr	Metamorphic reactions; isograds	portions of Winter 26
W	3	Project Work	
Th	4	Lecture **Exam 2**	(covers portions of Winter 9-19)
T	9	Metamorphic reactions; isograds	portions of Winter 26
W	10	**Lab 10** – High T and P rocks	
Th	11	Metamorphic reactions; Petrogenetic grids; Metacarbonates	portions of Winter 29
T	16	Metamorphic reactions; Petrogenetic grids	Winter 28
W	17	Project Work	
Th	18	Thermodynamics of metamorphic reactions	Winter 27
T	23	Metamorphic reactions; plotting reaction curves	Winter 27
W	24	Project Work	
Th	25	Project Work	
T	30	Student Presentations	
W	1 May	**Lab – Exam 2**	(covers Labs 5–10)
Th	2	Student presentations	
Th	9	**Lecture Exam 3** 1:00 pm	(covers portions of Winter 21 – 29)

This schedule is subject to change.

Lecture Examinations: Three lecture exams will be given on the dates indicated above. These exams will include questions derived from lecture material, homework, and assigned reading.

Lecture Grading:	Exams 1, 2, 3	70%
	Quizzes & Homework	10%
	Project	20%

Graduate students (Geol 622) will be required to submit a written report on an independent project.

Laboratory Examinations and Grading:
Laboratory (423/623) grading will be based on laboratory assignments and three exams (short answer, problem solving, identification). Graduate students (Geol 623) will be required to submit an independent project report.

Exams 1 and 2	50%
Lab assignments	50%

Special Needs:
Students with disabilities or other special needs, who need special accommodation, are invited to share these concerns or requests with the instructor and contact the Disability Services Office as soon as possible.

Academic Responsibility:
All work in this course must be completed in a manner consistent with NDSU Policy 335: Code of Academic Responsibility and Conduct (www.ndsu.edu/academichonesty/policy335/).

Intended Student Outcomes:
- To be able to identify common rocks and their constituent minerals in hand specimen and thin section
- To understand and be able to apply rock classification schemes
- To understand the processes which form igneous and metamorphic rocks.
- To understand the basis of and the use of phase diagrams in petrology.
- To use mineral reactions to describe the formation of metamorphic rocks.
- To appreciate the relationships between Earth history, igneous and metamorphic processes, and plate tectonics.
- To carry out an original research project on some aspect of petrology and present results to a peer audience