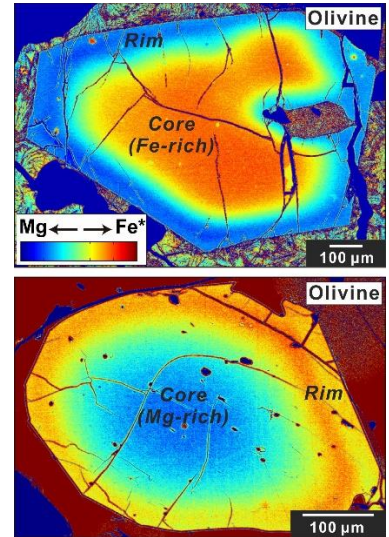


**Department of Earth Sciences**  
**ERTH 621 – Electron Microprobe Analysis**  
Fall 2023



(Left: [Electron Microprobe Facility](#) in POST 621; Right: X-ray maps of olivine, images credit – Dr. Thomas Shea)

**Lectures:** Tue & Thurs 3:00 – 3:50 pm in POST 613 (note: Lab work will be in POST 621), 2 credits

**Instructor:** Dr. Peng Jiang

**Contact information:** [pjiang@hawaii.edu](mailto:pjiang@hawaii.edu)

**Office location:** POST 612B

**Office hours:** After class and/or by appointment in my office or in the probe lab (POST 621)

## WHO SHOULD TAKE THIS COURSE?

If you have natural or synthetic materials (metals/alloys, organic/inorganic materials, minerals, glasses, etc.) that you want to characterize, from simple surface or chemical imaging to comprehensive compositional quantification at macro (cm) to micro-submicron scale, this course is right for you. You will be trained to use the instrument and acquire the desired data for your various research projects.

## COURSE DESCRIPTIONS

This is a graduate level course that is required\* for all new users of the [electron microprobe](#) at UHM. It has a lecture part and a lab part. The lecture part deals with the theory of electron-solid interaction, components of the probe, electronic imaging, X-ray mapping, **high spatial resolution** (micro-submicron scale) *in-situ* quantitative analysis (major, minor and trace elements in solid materials), and applications in various research projects. The lab part trains students to independently use the instrument, including sample preparation, sample change, imaging, mapping, analytical setup design, and data reduction and evaluation. Pre: EARTH 301 or consent.

**Benefits of taking this course:** Students will have a 1-day lab project correlated with their research, which will be free of charge. Additional days may be requested if the project is complicated.

\*Note that the probe lab only allows well trained users (by taking the EARTH 621 course) to operate the instrument. Assisted experiments by the lab manager may be charged at a higher rate.

## **COURSE OBJECTIVES**

By taking this course, students will know the basics of EPMA and be trained in independently operating the UHM electron microprobe. Students will gain confidence in designing their future probe-related experiments that help analyze their various research samples via imaging, mapping, semi-quantitative EDS analysis and high precision WDS quantitative analysis that benefit their thesis / dissertation.

## **COURSE COMPONENTS & STRUCTURE**

### **Course Lectures:**

#### ***Topics to be covered:***

- 1) Introduction to EPMA and its wide applications
- 2) Theory on electron-specimen interactions
- 3) Components of the electron microprobe (instrumentation)
- 4) Principles of wavelength dispersive X-ray spectroscopy (WDS)
- 5) WDS quantitative analysis: intensities to concentrations
- 6) Data quality evaluation: precision, accuracy and error analysis
- 7) Applications in Life, Earth and Planetary Sciences, Engineering and Material Sciences
- 8) Advanced EPMA topics and recent advances
  - Non-linear background regression, trace element analysis, beam-sensitive material analysis, secondary fluorescence corrections, etc.

#### ***Recommended reading:***

Reed, S.J.B., 2005. Electron Microprobe Analysis and Scanning Electron Microscopy in Geology (2<sup>nd</sup> edition). Cambridge University Press.

### **Labs & Homework:**

Labs & Homework are basically to understand the course materials, gain experience in operating the instrument and using the Probe for EPMA (PfE) software for routine quantitative analysis, and to know how to evaluate the EPMA data. These include assigned readings, CASINO modeling, guided probe and PfE software operation, data error analysis, etc.

### **Final Lab Project:**

Students will need to discuss with the instructor their proposed research projects, expected outcomes, and plan for the analytical setup. Each student will need to **reserve 1-day** for their final lab projects by the end of the semester. Students are expected to demonstrate their capability to work autonomously on the probe and will need to write a short research report (in a peer-reviewed article style).

## **GRADING**

### **Grading Structure:**

Course Attendance (**10%**)

Theoretic Exam (**30%**)

Labs & Homework (**20%**)

Final Lab Project (lab design, instrument operation & a written report) (**40%**)

## **Grading Scale:**

Students' final letter grades will be based on the total number of points based on weighted points from course attendance, theoretic exam, labs and homework and final lab project. *Note: plagiarism and/or cheating will result in an F for the course.* UH Mānoa uses the "plus" and "minus" system so the letter grades are assigned using the following scale:

A+ (97-100)   A (93-96.99)   A- (90-92.99)   B+ (87-89.99)   B (83-86.99)   B- (80-82.99)   C+ (77-79.99)  
C (73-76.99)   C- (70-72.99)   D+ (67-69.99)   D (63-66.99)   D- (60-62.99)   F (< 60)

## **STUDENT RESOURCES**

### **Statement on Disability: KOKUA Program**

If you have a disability and related access needs, please contact the KOKUA Program (Office for Students with Disabilities) at 956-7511, KOKUA@hawaii.edu, or go to Room 013 in the Queen Lili'uokalani Center for Student Services. Please know that I will work with you and KOKUA to meet your access needs based on disability documentation. Kokuu's services are confidential and offered free of charge.

### **Title IX:**

The University of Hawai'i is committed to providing a learning, working and living environment that promotes personal integrity, civility, and mutual respect and is free of all forms of sex discrimination and gender-based violence, including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence, and stalking. If you or someone you know is experiencing any of these, the University has staff and resources on your campus to support and assist you. Staff can also direct you to resources that are in the community. Here are some of your options:

**As members of the University faculty, your instructors are required to immediately report any incident of potential sex discrimination or gender-based violence to the campus Title IX Coordinator.**

Although the Title IX Coordinator and your instructors cannot guarantee confidentiality, you will still have options about how your case will be handled. Our goal is to make sure you are aware of the range of options available to you and have access to the resources and support you need.

If you wish to remain ANONYMOUS, speak with someone CONFIDENTIALLY, or would like to receive information and support in a CONFIDENTIAL setting, use the **confidential resources available here:** <http://www.manoa.hawaii.edu/titleix/resources/>.

If you wish to directly REPORT an incident of sex discrimination or gender-based violence including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence or stalking as well as receive information and support, contact: Dee Uwono Title IX Coordinator at (808) 956-2299 or [t9uhm@hawaii.edu](mailto:t9uhm@hawaii.edu).

More student resources can be accessed [here](#).