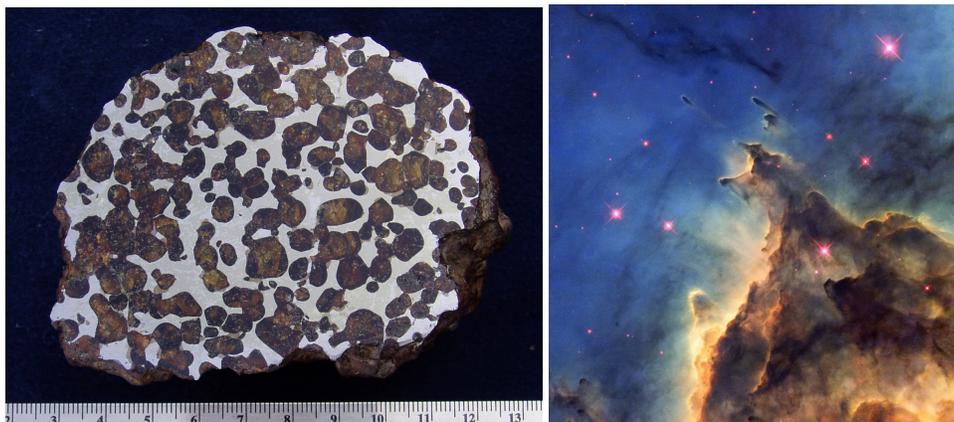


## ERTH 669: Cosmochemistry, Spring, 2022

### 3 Credits



**Instructor:** Dr. Gary R. Huss

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Office hours by appointment

**Lectures:** MWF 10:30 – 11:20 am in POST 613, 3 credits

**Textbook:** *Cosmochemistry 2<sup>nd</sup> edition*, by McSween and Huss

**Cosmochemistry** lies at the boundaries between chemistry, physics, geology, geochemistry astronomy, astrophysics, and biology. The intent of this class is to give the students a basic understanding of the compositions of the universe, the galaxy, stars, planets, asteroids, comets, and other objects and how they came to have those compositions. We will discuss major processes that operate in a wide variety of environment and investigate how they produced the object that we now see. Students will develop the tools to evaluate chemical and isotopic data obtained from remote sensing of planets, stars, galaxies and other objects and from laboratory analysis of samples from meteorites, comets, the Moon, and Mars.

**Catalog Description: EARTH 669 Cosmochemistry (3)** Formation and evolution of planets as astrophysical objects, geologic bodies, and abodes of life; current understanding from studies of the Solar System, star formation, meteorites, exoplanets; theory of formation and dynamics; atmospheres, oceans, habitability, biosignatures. Pre: EARTH 325 or CHEM 351 (or equivalent); or consent. (Alt. years)

#### Topics to be covered:

- 1) Isotopes, elements, structure of matter, basic chemistry
- 2) Origin of the elements
- 3) Cosmic and solar system abundances of the elements
- 4) Presolar grains: stellar condensates and interstellar dust
- 5) Meteorites: primitive materials from the early solar system
- 6) Chemical and isotopic fractionations
- 7) Chronology of the solar system
  - chronology using radioactive nuclides
  - chronology using cosmogenic nuclides and other techniques
- 8) Volatile elements and organic matter in the early solar system
- 9) Planetary accretion
- 10) Anhydrous asteroids
- 11) Comets and other icy bodies
- 12) Dust from comets and asteroids available for analysis on Earth

- 13) Formation and evolution of the terrestrial planets, esp. Moon and Mars
- 14) Models of the origin of the solar system

**Grading:** It is expected that students will attend all classes, do assigned readings prior to class, and participate in class discussion. Problem sets and writing assignments will be assigned on a regular basis and should be completed by the due date so that they can be discussed in class. There will be three take-home examinations designed to solidify the student's knowledge of the subject matter. In place of a final exam, each student will complete a class project on a topic of interest to the student. Each student will research a project topic, prepare a paper describing what they have learned, and present the results of their work to the class. Grades will be based on class participation (40%), homework assignments (10%), take-home exams (25%), and the final project (25%).

### **Learning Objectives**

The **Department of Earth Sciences** has defined 4 learning objectives for the MS degree and 5 for the PhD. EARTH669 addresses many of these:

- SLO1: proficiency in applying technical knowledge of theory, laboratory methods, field methods, and computer applications to solve real-world problems in earth and planetary sciences.
- SLO2: ability to comprehensively synthesis, evaluate, and interpret relevant fundamental knowledge in her of his sub-discipline.
- SLO3: students will learn about effective and ethical practice of the Scientific Method.
- SLO4: students will learn how to communicate scientific knowledge through writing and oral presentation.
- SLO5: students will acquire practical skills that are relevant to employability and to post graduate contributions to the advancement of Earth sciences and/or solution of societal problems.

All of these objectives will be addressed by class discussion, readings, homework problem sets, and preparing papers and presentations for the class.

**Disability Access:** If you have a disability and related access needs the Department will make every effort to assist and support you. For confidential services students are encouraged to contact the Office for Students with Disabilities (known as "Kokua") located on the ground floor (Room 013) of the Queen Lili'uokalani Center for Student Services:

KOKUA Program; 2600 Campus Road; Honolulu, Hawaii 96822 Voice: 956-7511; Email: [kokua@hawaii.edu](mailto:kokua@hawaii.edu) ; URL: <http://www.hawaii.edu/kokua>

**Discrimination:** 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:

**Title IX and Sex Discrimination is governed by Federal Law:** 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 (808) 956-2299 [t9uhm@hawaii.edu](mailto:t9uhm@hawaii.edu).