

**SYLLABUS**  
**ME589/ GEOC 589**  
**Advanced Topics—REE in coal (3 credits)**  
**Fall 2021**

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**OFFICE HOURS**—by appointment

**COURSE DESCRIPTION**

Critical minerals are mineral resources that are essential to our economy and whose supply may be disrupted. Rare earth elements (REE) are one group of the critical minerals. Most critical minerals are 100% imported into the U.S. Many critical minerals, including REE, are found in coal basins. New Mexico has a wealth of mineral resources and some of the critical minerals, including REE, are associated with coal deposits in the San Juan and Raton Basins in New Mexico. For example, vanadium and REE are associated with sandstone uranium deposits in the Grants uranium district in Jurassic stratigraphic units stratigraphically beneath the Cretaceous coal deposits. Uranium and vanadium have been produced from the La Ventana coals in the San Juan Basin. In addition to examining the REE potential throughout New Mexico, NMBGMR has already examined the REE and other critical minerals in Cretaceous beach placer sandstones, which are hosted by the formations underlying and overlying the coal beds. Graphite has been mined from metamorphic deposits adjacent to coal seams in the Raton Basin. Coal deposits from throughout the world are known to contain high concentrations of Al, Be, Cs, Ge, Ga, Re, Nb, Sc, Zr, V, U, and W, but a basin-wide geochemical and mineralogical study of New Mexico coals is needed to determine the potential for REE and these other critical minerals in New Mexico coals.

In this course, we will examine how coal is formed, where coal is found in New Mexico, source of REE and critical minerals in coal, evaluate the potential of REE and other critical minerals in coal deposits in New Mexico, including in mine waste products, and compare New Mexico coal deposits to other coal deposits in the world that contain REE and other critical minerals. Field trips will examine coal deposits in New Mexico. Lab exercises will examine drill core and hand specimens. We will also discuss how sampling plans are developed, petrographic and chemical analyses of coal, SOPs, mine safety, and other aspects of coal geology.

The class will meet one day (Tuesdays, room 253, Headon), with the remaining time spent on field trips or in occasional extra discussion sessions with visiting scientists. The class will be in person. There will be only a few lectures; most of the class will be discussion of various papers on REE in coal deposits.

**TEXTBOOK** (purchase from NMBMGR book store)

Hoffman, G.K., 2016, *Coal*, in McLemore, V.T., Timmons, S., and Wilks, M., eds., *Energy and mineral resources of New Mexico: New Mexico Bureau of Geology and Mineral Resources Memoir 50B*, and *New Mexico Geological Society Special Publication 13B*, 80 p.

Committee on Critical Mineral Impacts of the U.S. Economy, 2008, *Minerals, Critical Minerals, and the U.S. Economy: Committee on Earth Resources, National Research Council*, ISBN: 0-309-11283-4, 264 p., download from [http://www.nap.edu/catalog.php?record\\_id=12034#toc](http://www.nap.edu/catalog.php?record_id=12034#toc)

Papers as assigned

**CLASS DETAILS**

Exams: Midterm and Final—both are take home exams that will emphasize short answer and essay questions.

Term project—you are required to do a research project that will involve some original work on coal deposits. You can work on this as a team. It can be part of your thesis or other research project.

Discussion—I will assign papers to be read prior to class to be discussed by the class with one of you leading us. Each class member will be responsible for researching and leading the discussion (15 min each) on assigned papers.

Field trips—there will be 1 or more field trips and a field report on each trip will be required.

## PLACE IN CURRICULUM

This is an elective course but is recommended if you plan to participate in the DOE-funded REE in coal project or want to know about REE and REE in coal.

## COURSE LEARNING OUTCOMES

At the end of this course the student will understand the importance of REE and critical minerals and their availability from coal deposits.

## TENTATIVE COURSE SCHEDULE

Week of Aug 23	Introduction
Sept 14-18	NMGS field trip (I will be gone)
Oct 13	Midterm due
Nov 12	Optional field trip to Copper Flat mine, Hillsboro (copper mine)
Nov 22, 29	Term project presentation
Dec 3	Last day of classes
Dec 6	Final due
Dec 4-10	AEMA Reno (I will be gone)

<b>FINAL GRADE</b>	Midterm	20%
	Final (comprehensive)	30%
	Lab exercises	10%
	Term project	15%
	Field trip reports	10%
	Class Participation	15%

**Academic Honesty:** New Mexico Tech's Academic Honesty Policy for undergraduate and graduate students is found in the student handbook, which can be found at: <https://www.nmt.edu/studenthandbook/nmt-student-handbook.pdf>. You are responsible for knowing, understanding, and following this policy.

*[Note: It is a good idea to discuss what constitutes cheating in your class, particularly for homework and laboratory exercises. For example, do you permit students to consult on-line resources, such as Chegg homework solutions? Some faculty do, others do not. Let your students know what your policy is. For courses in which different faculty teach different sections, the faculty should agree to a uniform policy. Describe your plans for test proctoring and related honesty issues. For distance education courses, will students be monitored via Zoom during tests and if so inform students that they will be required to enable their video feed. If you plan to verbally quiz selected students on content to verify performance it would be good to let them know this.]*

## Reasonable Accommodations:

New Mexico Tech is committed to protecting the rights of individuals with disabilities. Qualified individuals who require reasonable accommodations are invited to make their needs known to the Office for Disability Services (ODS) as soon as possible. They will describe the process by which you can request such accommodations for this course. To schedule an appointment, please call 835-6209, or email [disability@nmt.edu](mailto:disability@nmt.edu).

**Counseling Services:**

New Mexico Tech offers individual and couples counseling, safety assessments, crisis intervention and consultations through The Counseling Center. These confidential services are provided free of charge by licensed professionals. For more information, please call 835-6619, email [counseling@nmt.edu](mailto:counseling@nmt.edu) or complete an Intake Form on our website at <https://www.nmt.edu/cds/>. All services are provided via phone or Zoom during the Covid-19 pandemic.

**Respect Statement:** New Mexico Tech supports freedom of expression within the parameters of a respectful learning environment. As stated in the New Mexico Tech Guide to Conduct and Citizenship: “New Mexico Tech’s primary purpose is education, which includes teaching, research, discussion, learning, and service. An atmosphere of free and open inquiry is essential to the pursuit of education. Tech seeks to protect academic freedom and build on individual responsibility to create and maintain an academic atmosphere that is a purposeful, just, open, disciplined, and caring community.”

**COVID-19 Safety Issues for Face-to-Face Instruction:** As of the beginning of Fall semester, NMT classes are under the following constraints, which may change as COVID conditions and/or New Mexico Governor’s orders change. Please check for daily updates of COVID constraints, posted on [www.nmt.edu/covid19/](http://www.nmt.edu/covid19/).

- 1) All vaccinated and unvaccinated individuals are required to wear a face mask indoors anywhere on campus. It is anticipated based on prior Governor’s orders that, when conditions improve individuals who have not been fully vaccinated will still be required to wear a face mask and to social distance indoors. Vaccinated individuals, in contrast, would not be required to wear a mask indoors but are welcome to still wear a mask if they choose to, so please do not assume that individuals wearing masks are unvaccinated.
- 2) Instructors and TAs will not ask for proof of vaccination. This, too, may change in response to changing conditions.
- 3) Please note provisions on masks, vaccines or other possible requirements are subject to change as the situation evolves, based on guidance from the Centers for Disease Control, the State of New Mexico, and university officials (i.e., the President and the Board of Regents).
- 4) Students should not come to class if they are feeling ill and to follow any quarantine guidelines that they are given in the event of exposure to COVID-19. If you do miss class, please contact the instructor for missed assignments, contact the Student Health Center, and consider getting tested for COVID-19.

For the most up-to-date guidelines, please consult NMT’s COVID- 19 information page:  
<https://www.nmt.edu/covid19/>.

**Title IX Reporting:**

Sexual misconduct, sexual violence and other forms of sexual misconduct and gender-based discrimination are contrary to the University’s mission and core values, violate university policies, and may also violate state and federal law (Title IX). Faculty members are considered “Responsible Employees” and are required to report incidents of these prohibited behaviors. Any such reports should be directed to Tech’s Title IX Coordinator (Dr. Peter Phaiyah, 216 Brown Hall, 575-835-5880 (O), 575-322-0001 (C), [titleixcoordinator@nmt.edu](mailto:titleixcoordinator@nmt.edu) ). Please visit Tech’s Title IX Website ([www.nmt.edu/titleix](http://www.nmt.edu/titleix)) for additional information and resources.