

ME571/GEO589—Special topics

Exploration, mining and environmental geochemistry of uranium deposits

This special topics class will summarize and discuss various topics on uranium deposits, including geology, exploration, mining, and environmental aspects. The class is intended for non-geology majors as well as geology majors. The class will meet once a week for 2-3 hours with additional time allotted for field trips. There may be some lectures by guest speakers. Each student will be responsible for discussing a topic or published paper during the semester. Field trips will include examination of sedimentary sequences and uranium deposits in the Socorro area and the San Juan Basin. Students will also complete a written class project and present an oral version to the class (current student work, if appropriate, will be accepted and students can work on this as a team). Final grades will be determined by:

- class participation (20%)
- student project (20%)
- field trip reports (20%)
- mid term exam (20%)
- final exam (20%)

Plan to cover the following:

- What types of uranium deposits are found in sedimentary host rocks within basins?
- What are the depositional environments of sediments hosting uranium deposits?
- How do these depositional environments affect exploration, mining, environmental chemistry and processing of sediment-hosted uranium deposits?
- What types of basins do uranium deposits occur?
- Why is stratigraphy important in uranium exploration, mining, and understanding the formation of uranium deposits?
- What are the tools required for basin analysis and exploration of uranium deposits?
- Why are uranium deposits found in sedimentary basins so economically important?
- What are the different mining and processing of uranium deposits?
- What geochemical controls affect uranium deposition and subsequent leaching and processing of uranium ores?
- What are the environmental effects of uranium mining?

The objectives of the course are:

- Develop student awareness of issues surrounding exploring, mining, and reclamation of uranium deposits and mines.
- Foster critical thinking and problem-solving skills with this developing awareness.
- Promote a multifaceted approach to teaching science through the use of debate, writing, and hands-on activities.

Preliminary Schedule by Week

- Jan 18 ***Introduction***
- Jan 25 ***Uranium background***
 - Life cycle of uranium
 - Environmental issues
 - Chemistry of uranium deposits
- Feb 1 ***Types of uranium deposits***
 - Sedimentary-hosted deposits
 - Vein deposits
 - Surficial deposits
 - Porphyry deposits
- Feb 8 ***Exploration techniques*** (what tools do we have available for our use)
 - Historical data
 - Radiometric surveys
 - Gravity/magnetic surveys

- Geophysical logging
- Drilling (geophysical, lithologic logs)
- Geologic mapping
- Sampling (surface)
- Sampling (metallurgical)
- Feb 15 *How do we manage data?*
 - Read McLemore, Veeger
- Week of Feb 22 SME—no class (take home mid term)
- Feb 29 *Data Interpretation and Analysis*
- March 7 *Sedimentary processes*
- March 14 spring break—no class
- March 21 *Sedimentary processes*
- March 28 *Sustainable development*
- April 4 *Basin Analysis*
- April 11 *Mining of uranium*
- April 18 *Reclamation of uranium*
- April 25 class presentations
 - **Take home final**
- May 2 class presentations
- **Final Exam, research report** due by noon on May 6th

FIELD TRIPS IN FEB, APRIL

READING LIST

- Barton, M.D., Johnson, D.A., and Zürcher, L., 2000, Phanerozoic iron-oxide (REE-Cu-Au-U) systems in southwestern North America and their origins, *in* Roberts, M.D., and Fairclough, M.C., eds., *Fe-oxide-Cu-Au Deposits: A discussion of critical issues and current developments*: EGRU Contributions 58, James Cook University, Australia, p. 5–11, http://www.geo.arizona.edu/~mdbarton/MDB_papers_pdf/Barton00_IOCG_SWNA_JCU.pdf
- Burns, P.C. and Sigmon, G.E., 2013, *Uranium—cradle to grave*: Mineralogical Society of Canada, Short Course Series, v. 43, 437 p.
- Culbert, R.R., and Leighton, D.G., 1988, *Young Uranium*: Ore Geology Reviews, v. 3, p. 313-330
- International Atomic Energy Agency (IAEA), 2009, *World distribution of uranium deposits with uranium deposit classification*: IAEA Report IAEA-TECDOC-1629, 126 p., <http://www-pub.iaea.org/MTCD/publications/PDF/TE_1629_web.pdf>
- International Atomic Energy Agency, 2000, *Methods of Exploitation of Different Types of Uranium Deposits*: IAEA, VIENNA, IAEA-TECDOC-1174, 84 p., http://www-pub.iaea.org/MTCD/Publications/PDF/te_1174_prn.pdf
- McLemore, V.T., Hill, B., Khalsa, N., and Lucas Kamat, S.A., 2013, *Uranium resources in the Grants uranium district, New Mexico: An update*: New Mexico Geological Society, Guidebook 64, p. 117-126, https://nmgs.nmt.edu/publications/guidebooks/downloads/64/64_p0117_p0126.pdf
- Ottom, J.K., 1984, *Surficial uranium deposits in the United States of America*; *in* *Surficial uranium deposits*: International Atomic Energy Agency, Vienna, Austria, IAEA-TECDOC-322, p. 237–242, <http://www-pub.iaea.org/MTCD/publications/PDF/te_322_web.pdf>
- Ruzicka, V., 1993, *Vein uranium deposits*: Ore Geology Reviews, v. 8, p. 247-276
- Rogers, J.W., Ragland, P.C., Nishimori, R.K., Greenberg, J.K., and Hauck, S.A., 1978, *Varieties of Granitic Uranium Deposits and Favorable Exploration Areas in the Eastern United States*: *Economic Geology*, Vol. 73, p. 1539-1555