

SOILS 519 - The Nature of Soil Minerals, Fall Sem., MWF 1:25 - 2:15p.m., 214 MRL

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Course Objective: To acquaint those students who do not specialize in soil (clay) mineralogy with the types of information obtained from a study of clay minerals and the methods used to obtain it.

1. Mineralogical Background

a. Rocks

- 1) Igneous
- 2) Sedimentary
- 3) Metamorphic

b. Classification and Nomenclature of the Clay Minerals

c. Structure of Specific Minerals

- 1) Silicates
- 2) Hydroxides
- 3) Amorphous

2. Methods of Clay Mineral Identification

a. X-ray Diffraction

b. Thermal Methods

- 1) DTA-differential thermal analysis
- 2) TGA-thermal gravimetric analysis

c. Infrared Absorption

d. Electron Microscopy

3. Chemical Methods

a. Quantitative clay mineral determination

b. Cation exchange capacity

c. Surface area

d. Differential dissolution

e. Free oxide removal

f. Organic matter removal

4. Application to Soils

a. Soil composition

- 1) Elemental
- 2) Mineralogical

b. Soil genesis

- 1) Weathering of clay minerals
- 2) Clay mineral formation

c. Minerals and soil properties

- 1) Ion exchange, sorption and selectivity
- 2) Clay mineral - organic reactions
- 3) Clay-water system - swelling and shrinkage

Text Required: J.B. Dixon and S.B. Weed (eds.). Minerals in Soil Environments (Second Edition), Publ. by Soil Science Society of America, Madison, WI, 1989, pp. 1244.

References:

The references for this course are given in the approximate order of their importance.

1. Soil Chemical Analysis--Advanced Course, M.L. Jackson, Publ. by the Author, Dept. of Soils, Univ. of Wisconsin-Madison, Madison, WI 53706 (1979).
2. J.B. Dixon and D. G. Schulze (eds.). Soil Mineralogy with Environmental Applications, Publ. by Soil Science Society of America, Madison, WI, 2002, pp. 866.
3. Crystal Structures of Clay Minerals and Their X-Ray Identification (Eds. G.W. Brindley and G. Brown), Mineralogical Society, London, 1980, pp. 495.
4. Clay Mineralogy (Second Edition), R.E. Grim, Publ. by McGraw Hill, New York, 1968, pp. 596.
5. An Introduction to Clay Colloid Chemistry (Second Edition), H. van Olphen, Publ. by John Wiley & Sons, New York, 1977, pp. 318.

Breakdown of Percentages for Final Grade:

Midterm 1	33.3%
Midterm 2	33.3%
Final Exam	33.3%