Lecture 1 (9/6/2006) - Introduction to Mineralogy

Mineralogy/Mineral Science – The study of the chemistry, atomic structure, physical properties, and genesis of minerals

Subfields:
- Descriptive Mineralogy – documenting physical and optical properties
- Crystal Chemistry – relationship of chemical composition to atomic structure
- Crystallography – relationship of atomic structure to crystal symmetry
- Mineral Genesis – interpreting the geologic setting in which a mineral forms from its physical, chemical, and structural attributes and its associated minerals

Fundamental to all other branches of Earth Science
- Petrology – the study of the origin of rocks is largely determined by evaluating the structure, texture, and chemistry of the minerals they contain.
- Geochemistry – study of the chemistry of earth materials which reflects the collective chemistry of the minerals they contain.
- Structural Geology and Tectonics – Deformation of rocks is controlled by the orientation and crystal structure of its constituent minerals.
- Environmental Geology/Hydrogeology – the study of how the biosphere/hydrosphere, and atmosphere interacts with rock and minerals (the lithosphere).
- Economic Geology – study of the origin and beneficiation of mineral deposits.

Definition – A mineral is a naturally occurring solid with a highly ordered atomic arrangement and a definite (but not fixed) chemical composition. It is usually formed by inorganic processes.

History of Mineralogy
- Mineral “arts” dates back to early human civilization
- Mineral science begins with Renaissance/ Age of Reason (Agricola, 1556; Steno 1669)
- 1700’s measurements of crystal geometry and symmetry
- Early 1800’s precise measurements of crystal symmetry heralds the field of crystallography; analytical chemistry leads to chemical classification of minerals
- Late 1800’s – creation of polarizing microscope opens field of petrography and the study of optical properties of minerals
- Early 1900’s - X-ray diffraction measurements allows for precise measurement of internal symmetry and structure of minerals
- 1960 – development of the electron microprobe allows for accurate in situ analysis of mineral chemistry
- 1970 – development of transmission electron microscope allow for visualization of atomic structure and symmetry
- 1980 – ion microprobe allow for study of isotopic composition of minerals

Economic Importance of Minerals
Classification and Naming of Minerals – few rules; some local notables – pigeonite, grunerite, hibbingite