Space Rocks Tell Their Secrets

Astromaterials Research and Exploration Science (ARES)

NASA Johnson Space Center March 29, 2003

Antarctic Meteorite Program

- NSF-led field teams recover hundreds of meteorites each year
- Meteorites are sent to a cleanroom at NASA JSC for description and distribution

Meteorite Processing Lab

Nitrogen Glove Box Cabinet

Microscope View Port

Laminar Flow Bench

Describing Meteorites

- Photograph, weigh and measure
- Describe exterior color, texture
- Break open – describe interior
- Magnify - describe minerals, texture

Meteorite Exterior

Meteorite Interior

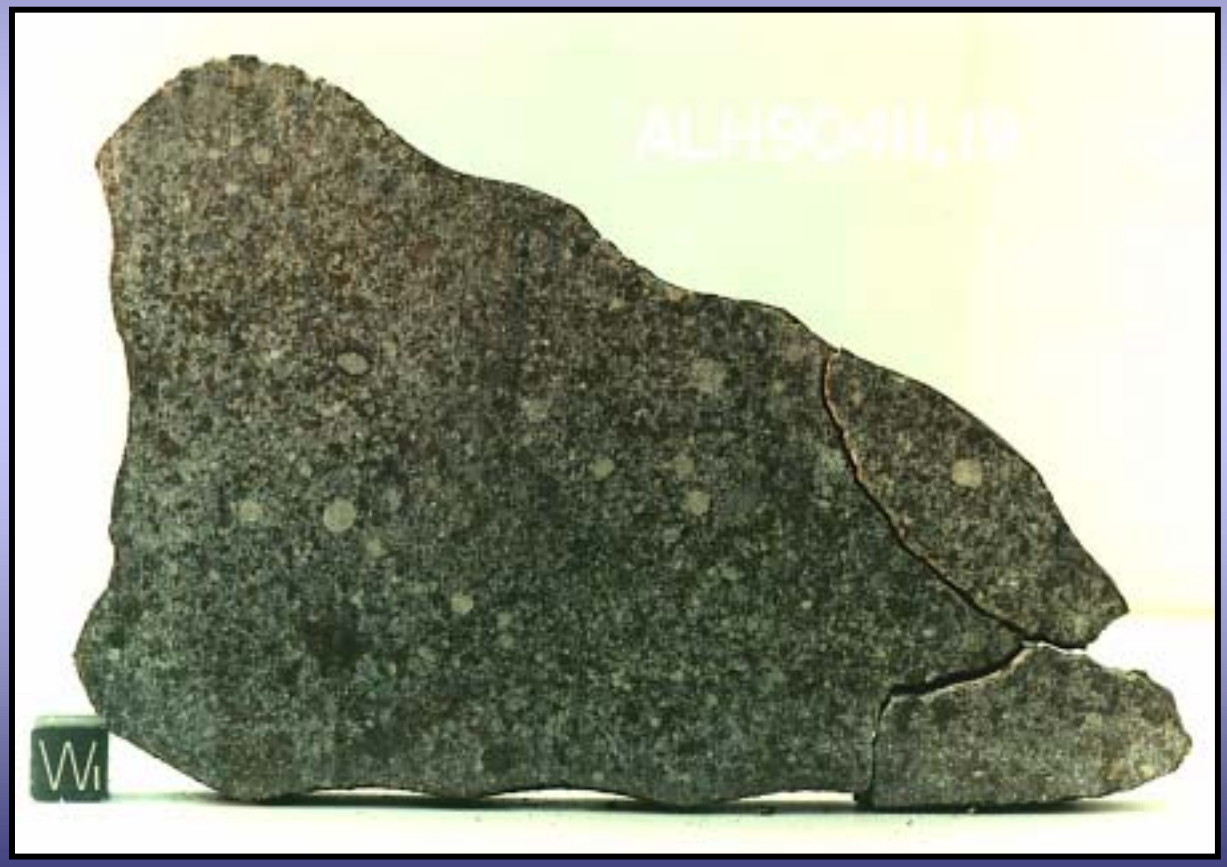
Meteorite Magnified

Meteorite Thin Section

Classifying Meteorites

- Stony
  - Chondrite
  - Achondrite
- Iron
- Stony Iron

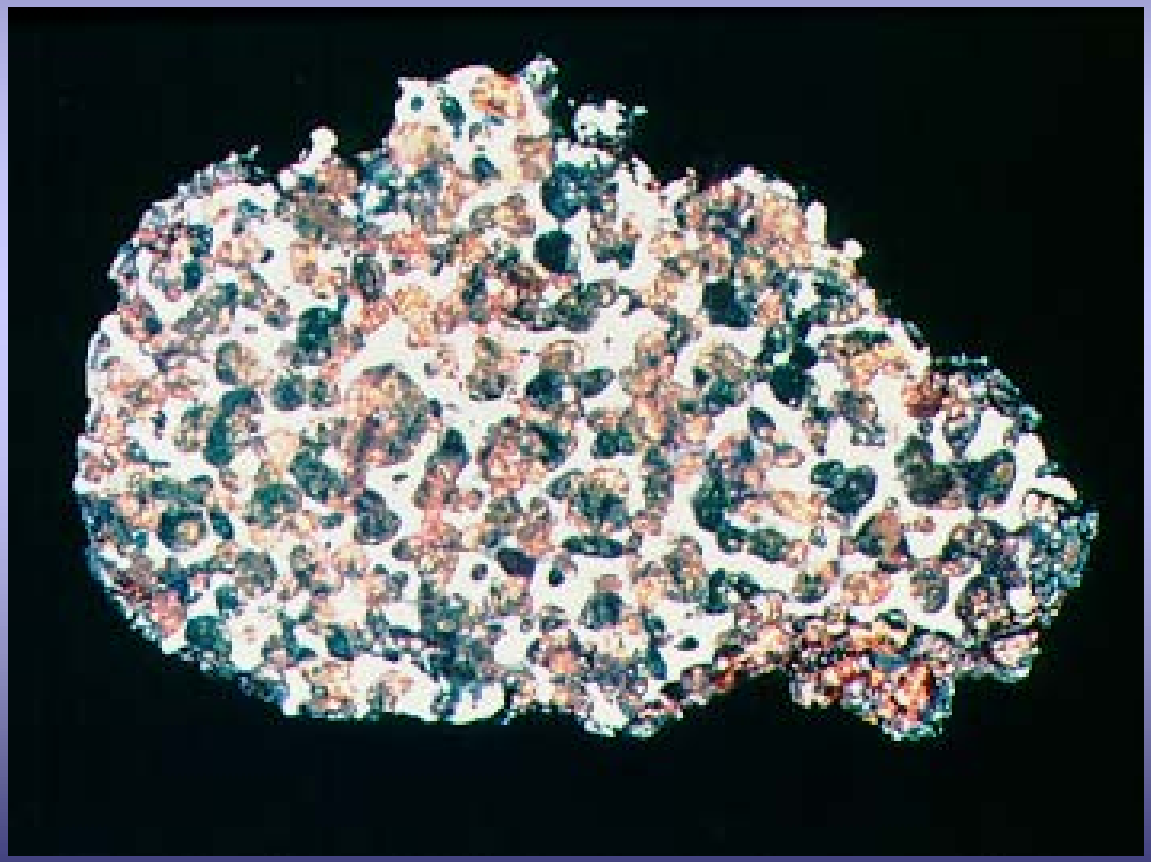
Chondrite Meteorite



Achondrite Meteorite

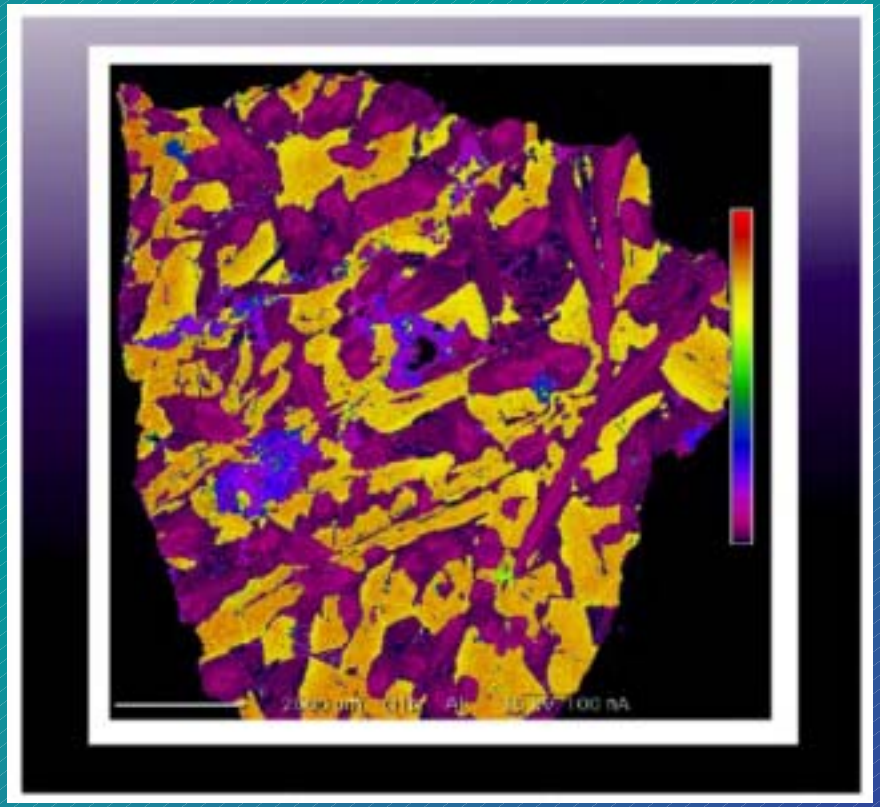
Iron Meteorite

Stony Iron Meteorite

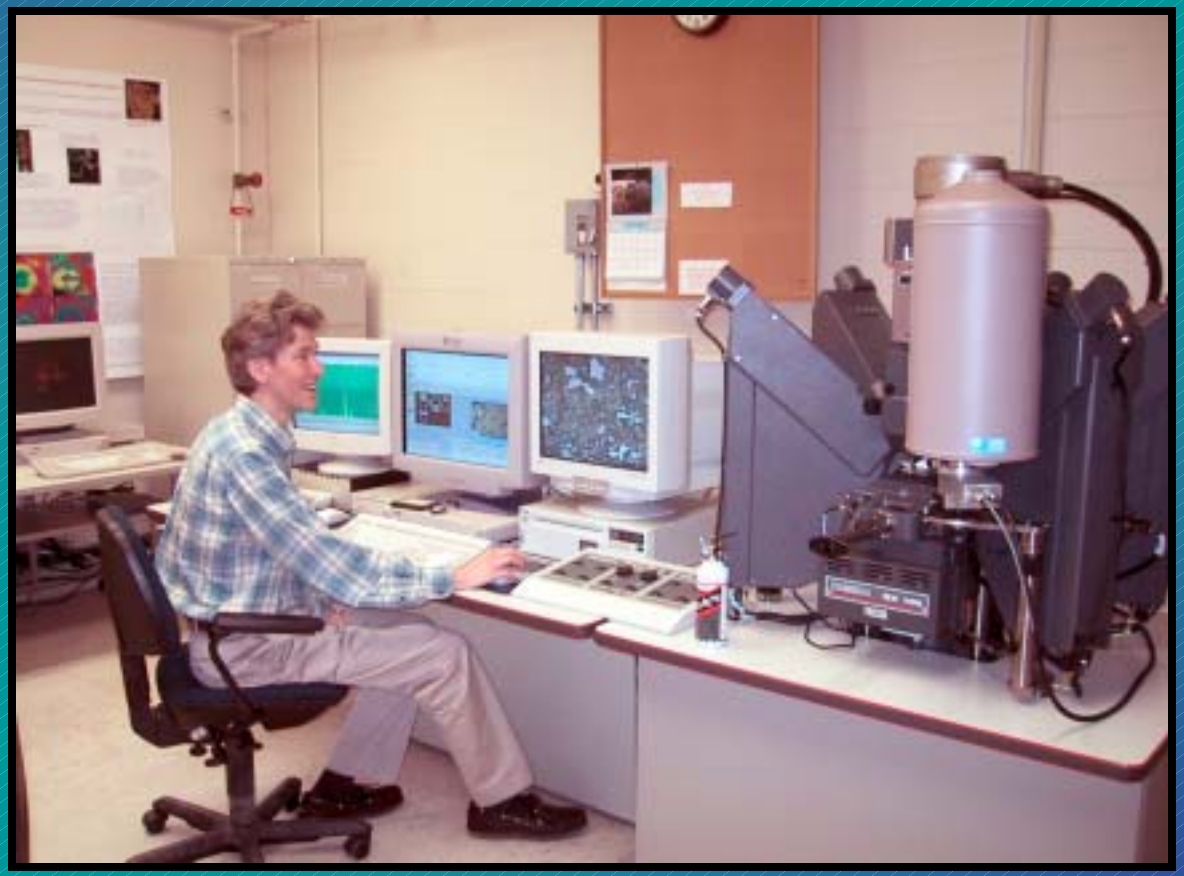


Electron Microbeam Labs

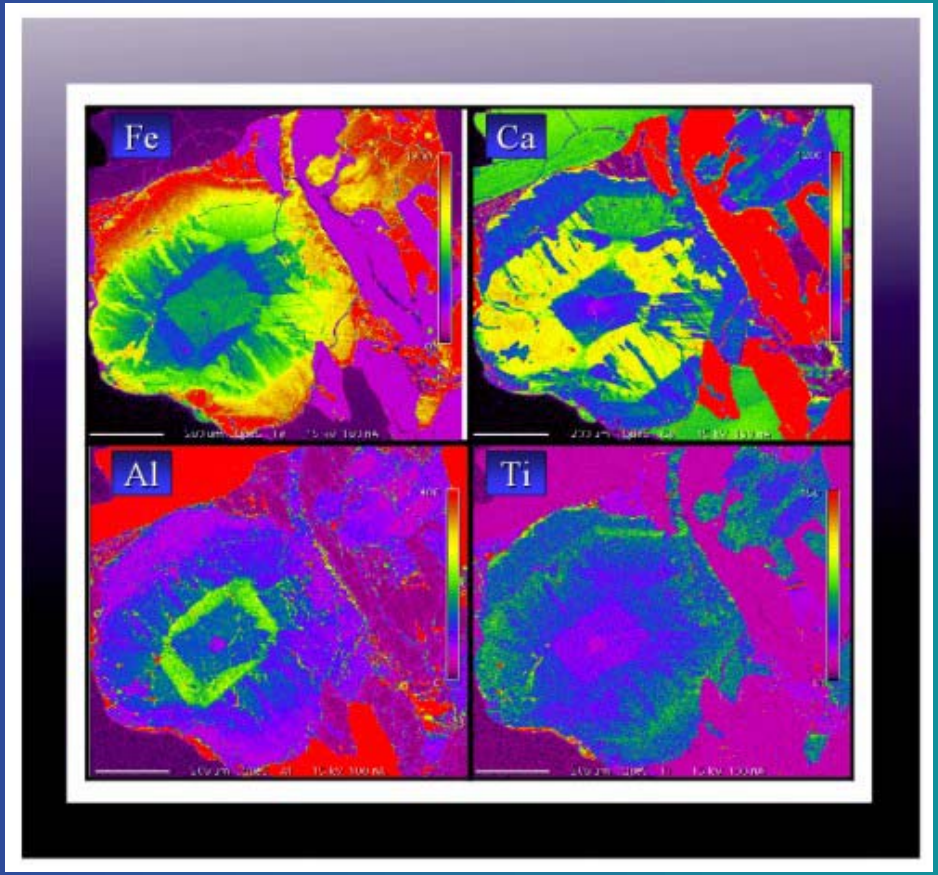
- Use electron beams to produce x-rays
- Image and map minerals
- Analyze mineral compositions



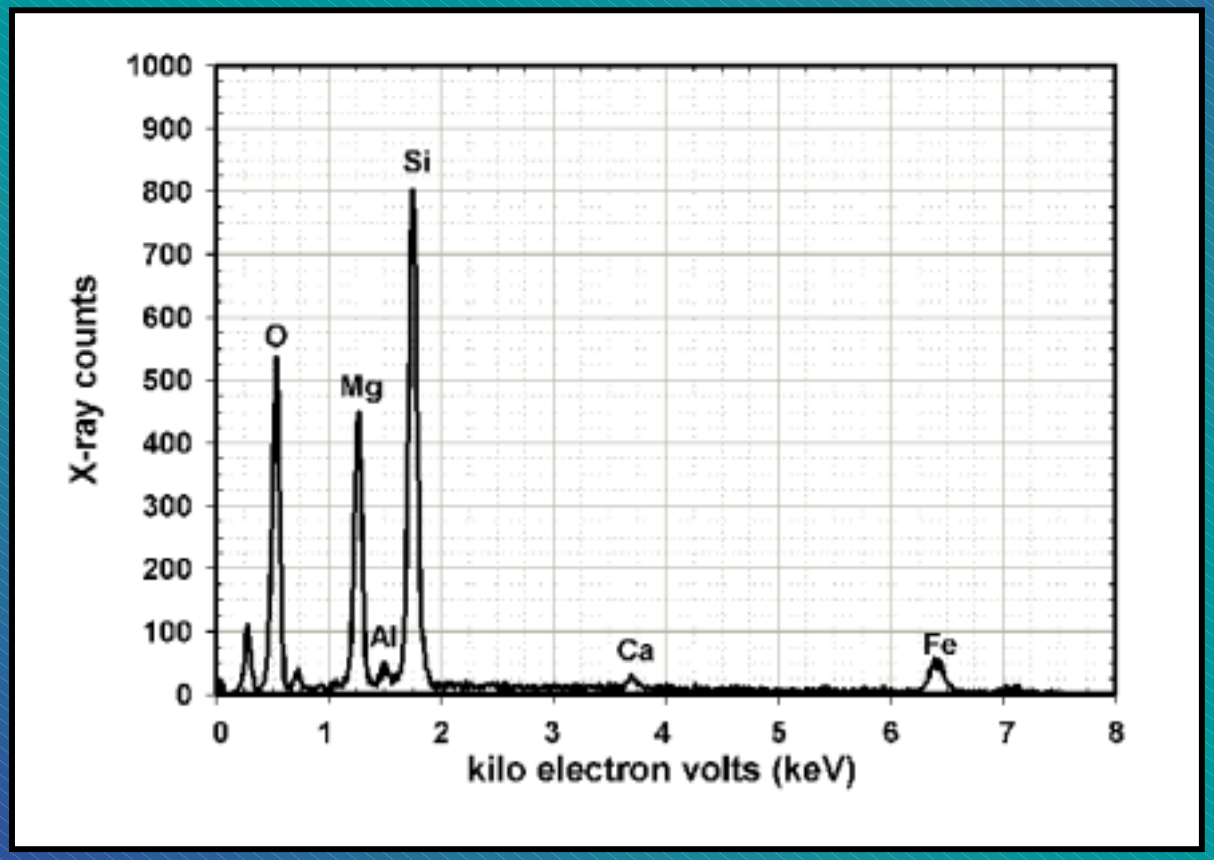
Electron Microprobe Lab



Element Scan

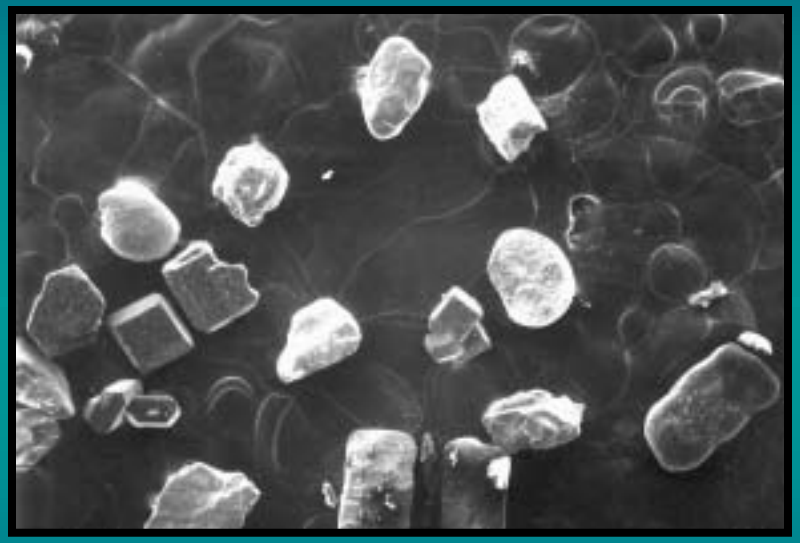


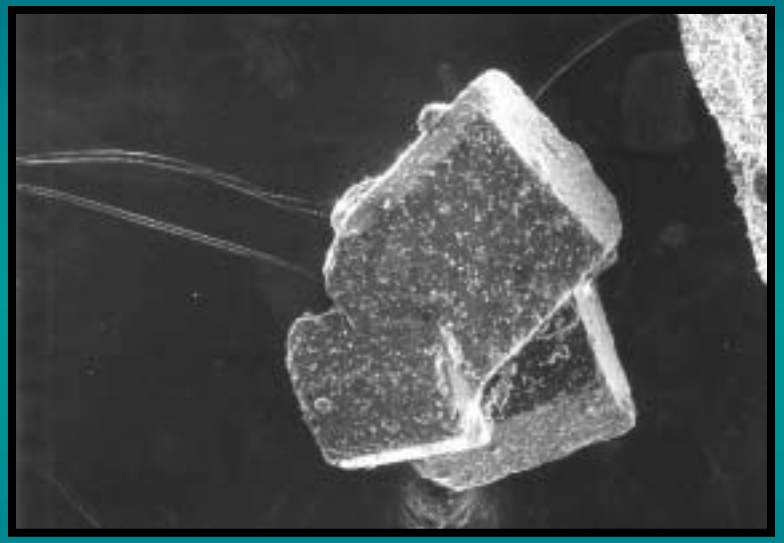
X-Ray Spectrum



Scanning Electron Microscope

SEM Image



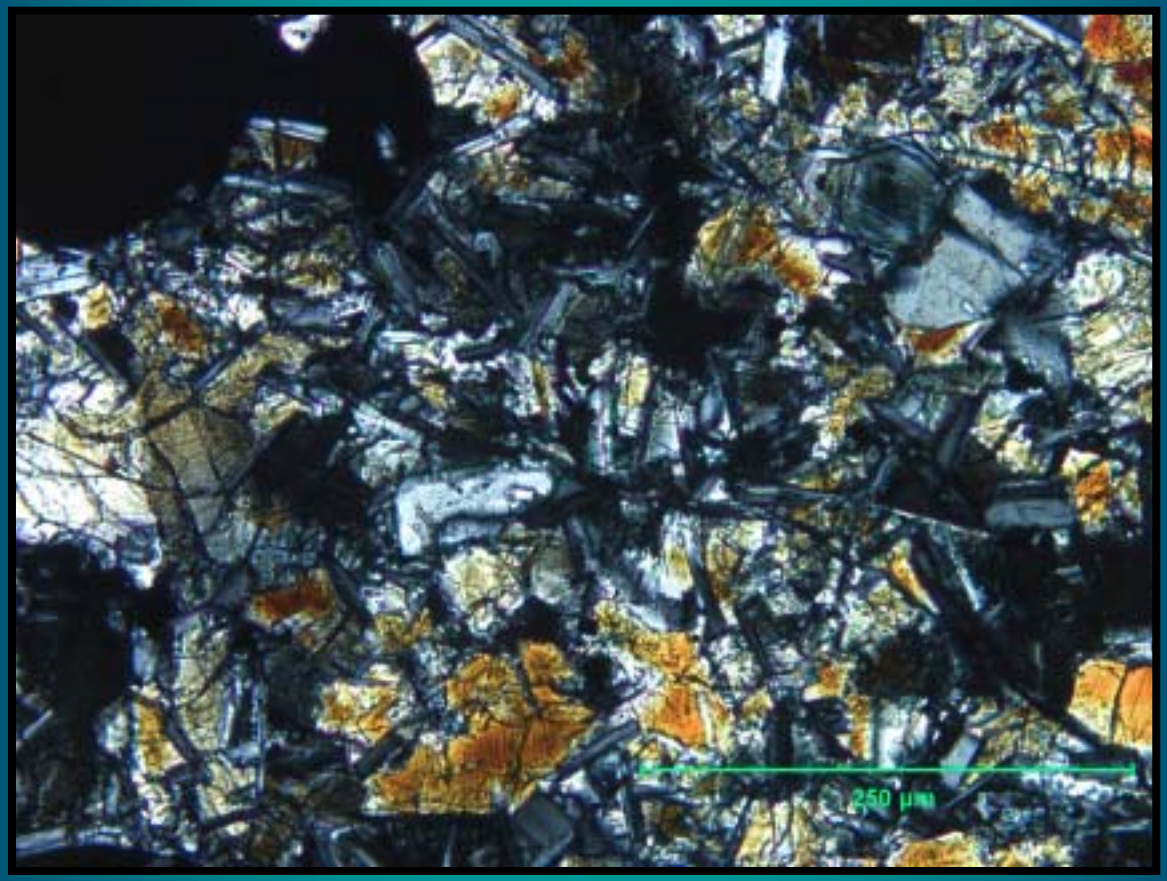


Transmission Electron Microscope

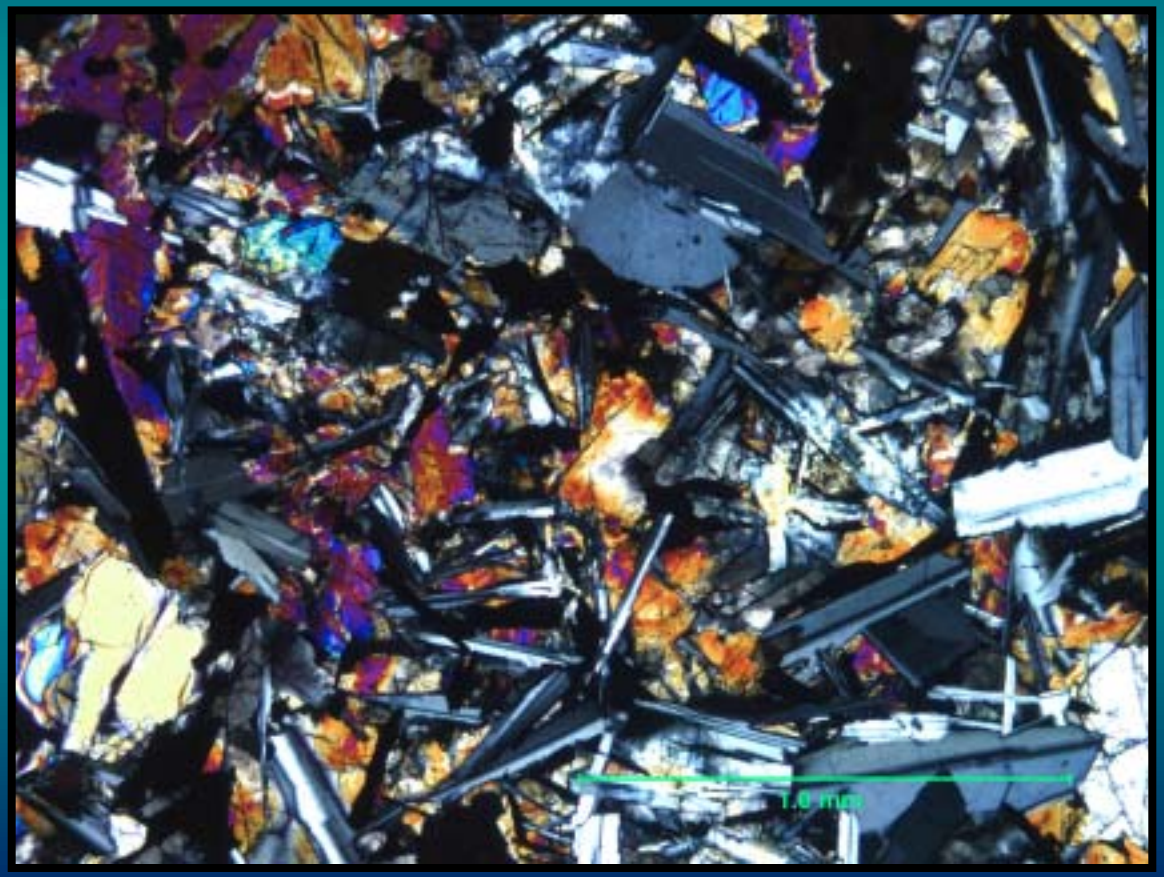
Classifying Achondrite Basalts

- Basalts common in inner solar system
- All made mostly of pyroxene, plagioclase
- Minor minerals vary
- Mineral compositions used to classify

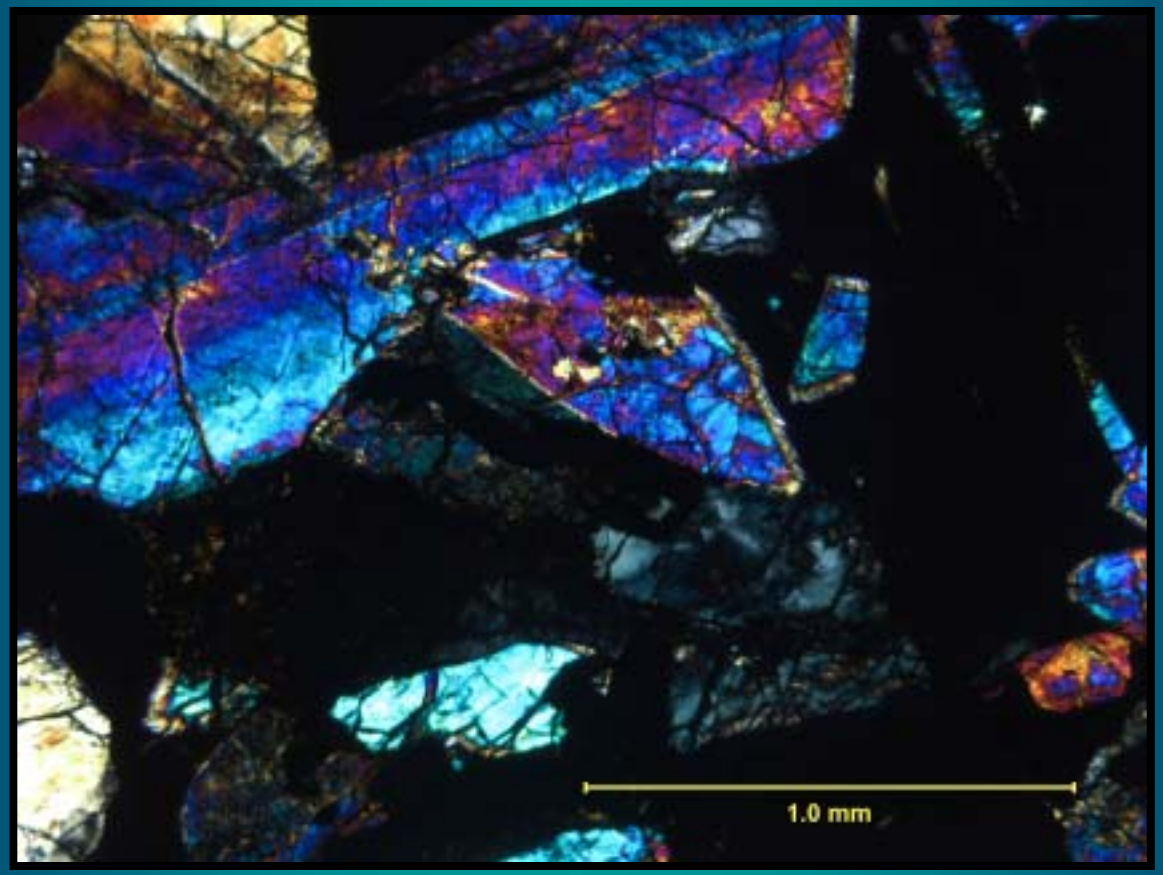
Asteroid Basalt



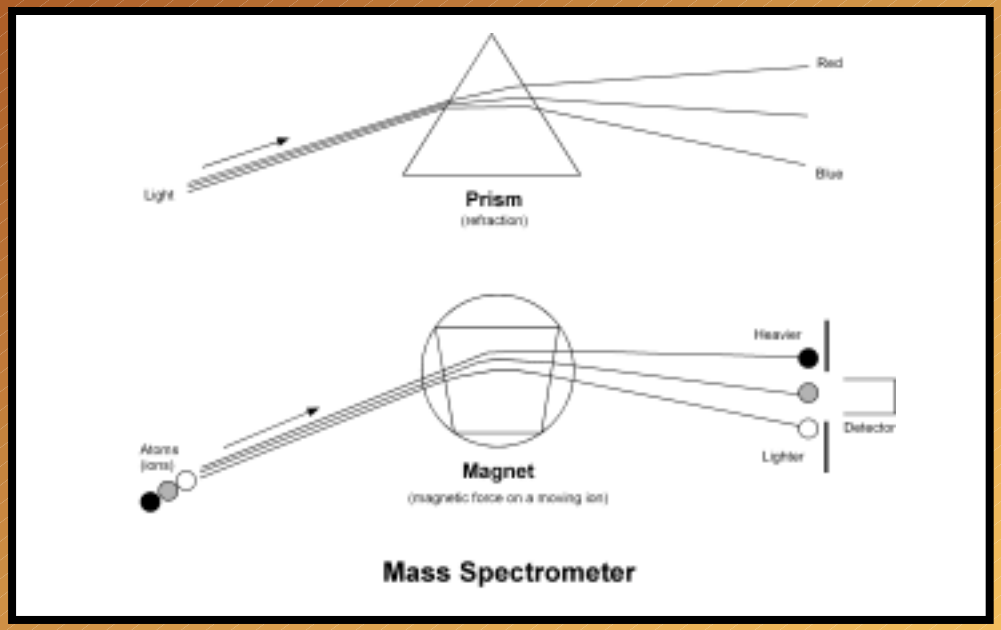
Lunar Basalt



Martian Basalt



Mass Spectrometry Labs



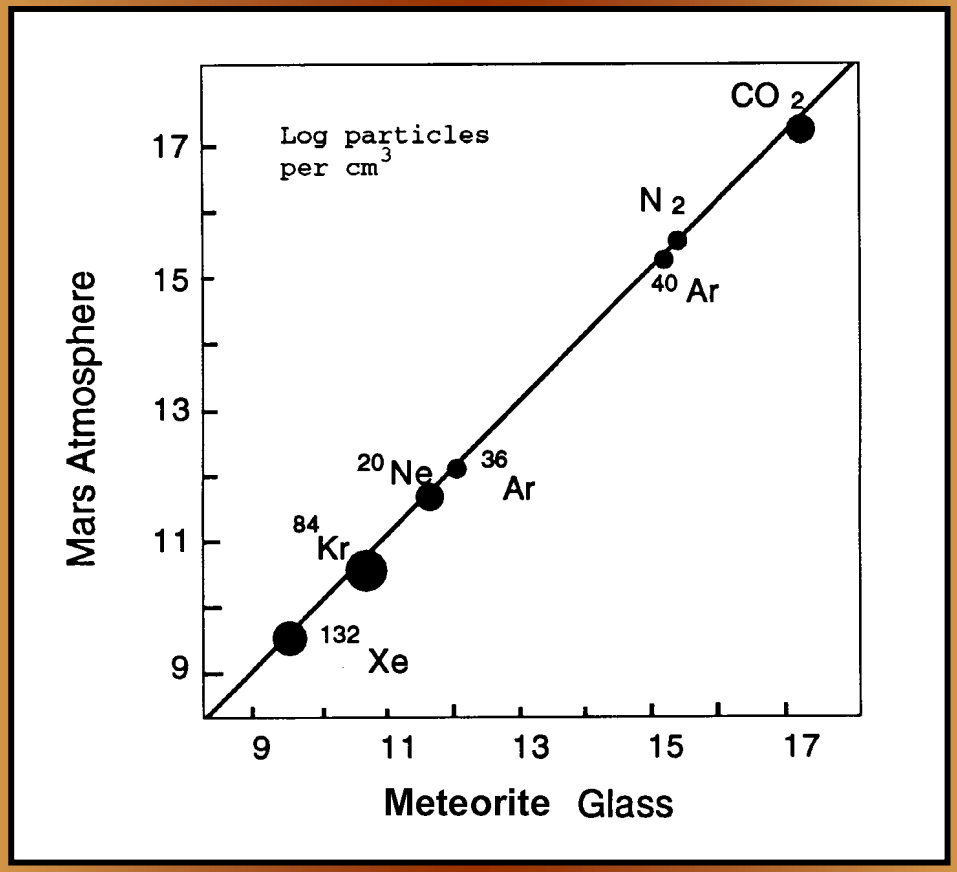
- Use magnets to separate isotopes of an element
- Use radioactive isotopes to date ages of rocks
- Use stable isotopes to identify parent bodies

Thermal Ionization Lab

Rb/Sr Isochron

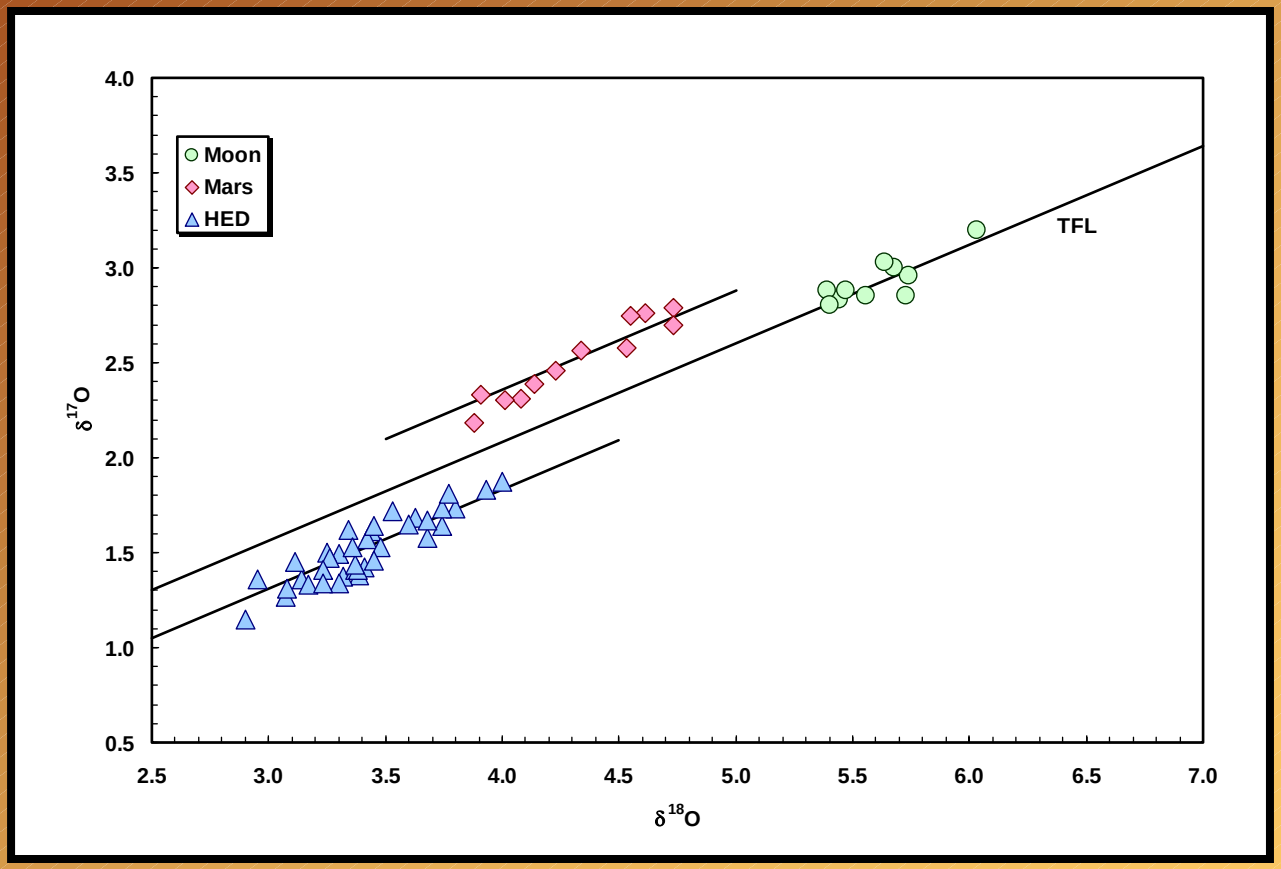
Noble Gas Lab

Atmospheric Gases



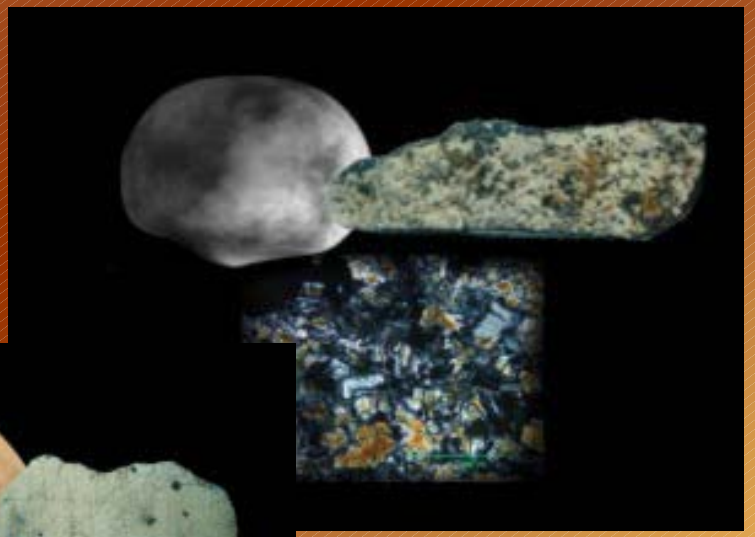
Stable Isotope Lab

Oxygen Isotopes

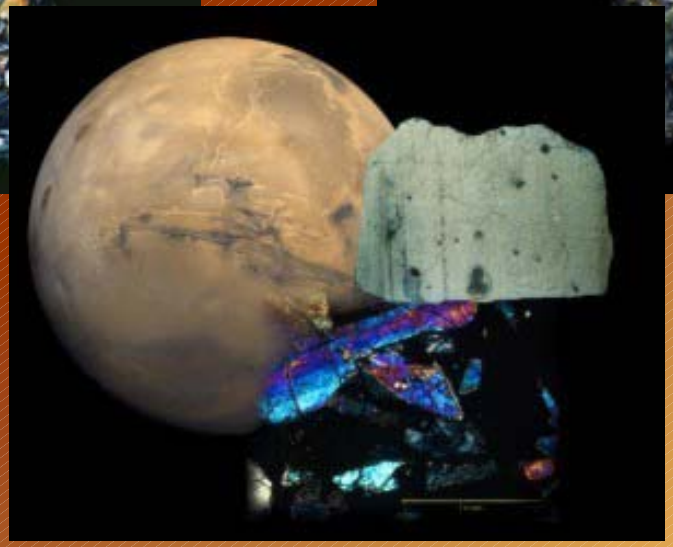


Meteorite Parent Bodies

Lunar Mare Basalt



Asteroid Vesta and Basaltic Achondrite (Eucrite)



Martian Basaltic Shergottite