Chapter 2 Lab

Mineral Identification

Hand Tools for Mineral Identification

- Hand lens
- Hardness tools
  - Fingernail
  - Copper penny
  - Glass plate
  - Steel file
- Streak plate
- Dilute hydrochloric acid
- Magnet

Physical properties

- Luster
- Cleavage
- Hardness
- Crystal form
- Color
- Streak
- fizz

Mineral *Properties*

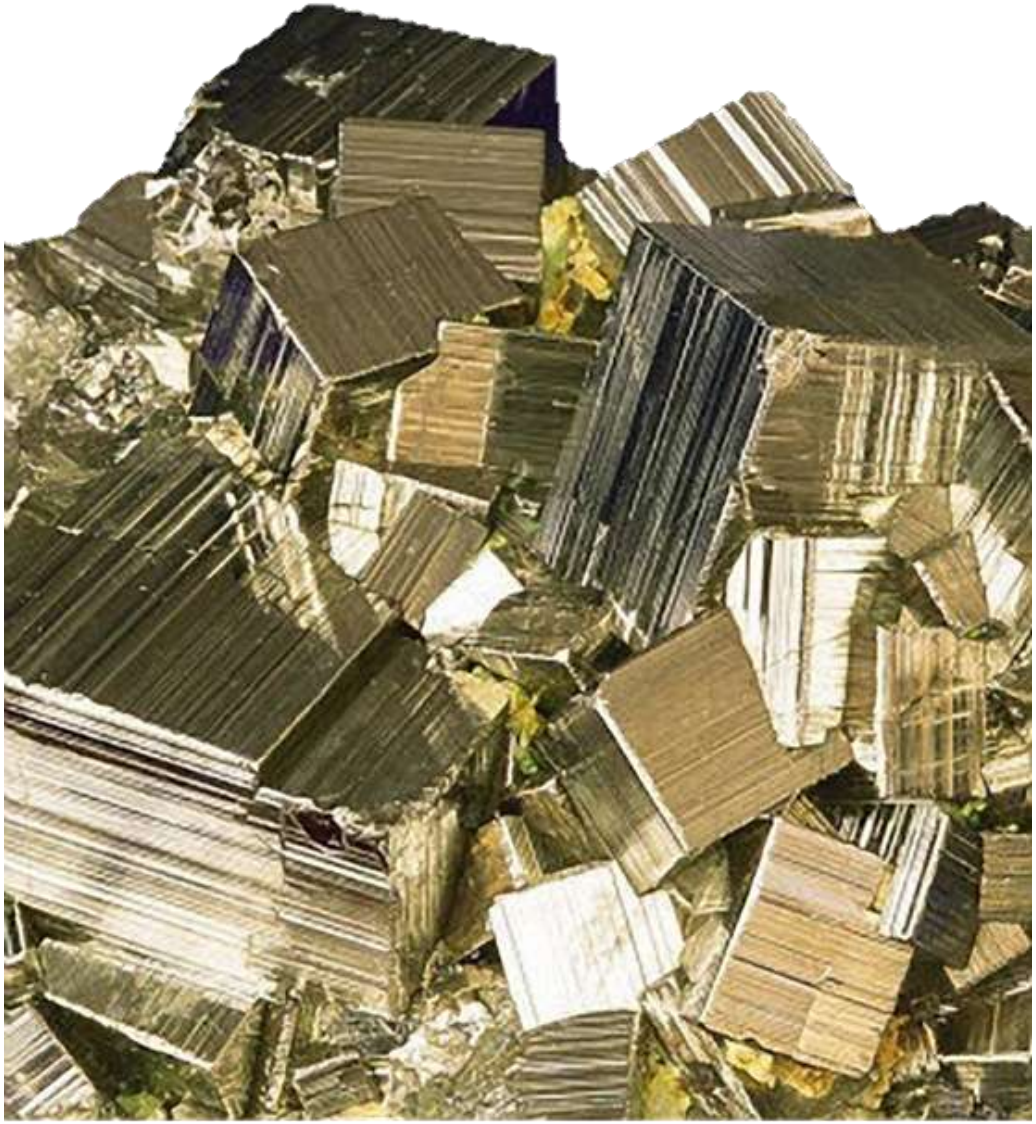
- **Luster**
  - Reflected light off mineral surface
  - Metallic or Nonmetallic

Luster

- Metallic – looks like a metal – brass, copper, steel, aluminum, silver, gold, cast iron
- Nonmetallic – does not look like a metal

Metallic Luster

Pyrite – metallic luster



Cleavage, fracture

- Cleavage = ability of a mineral to break along preferred planes

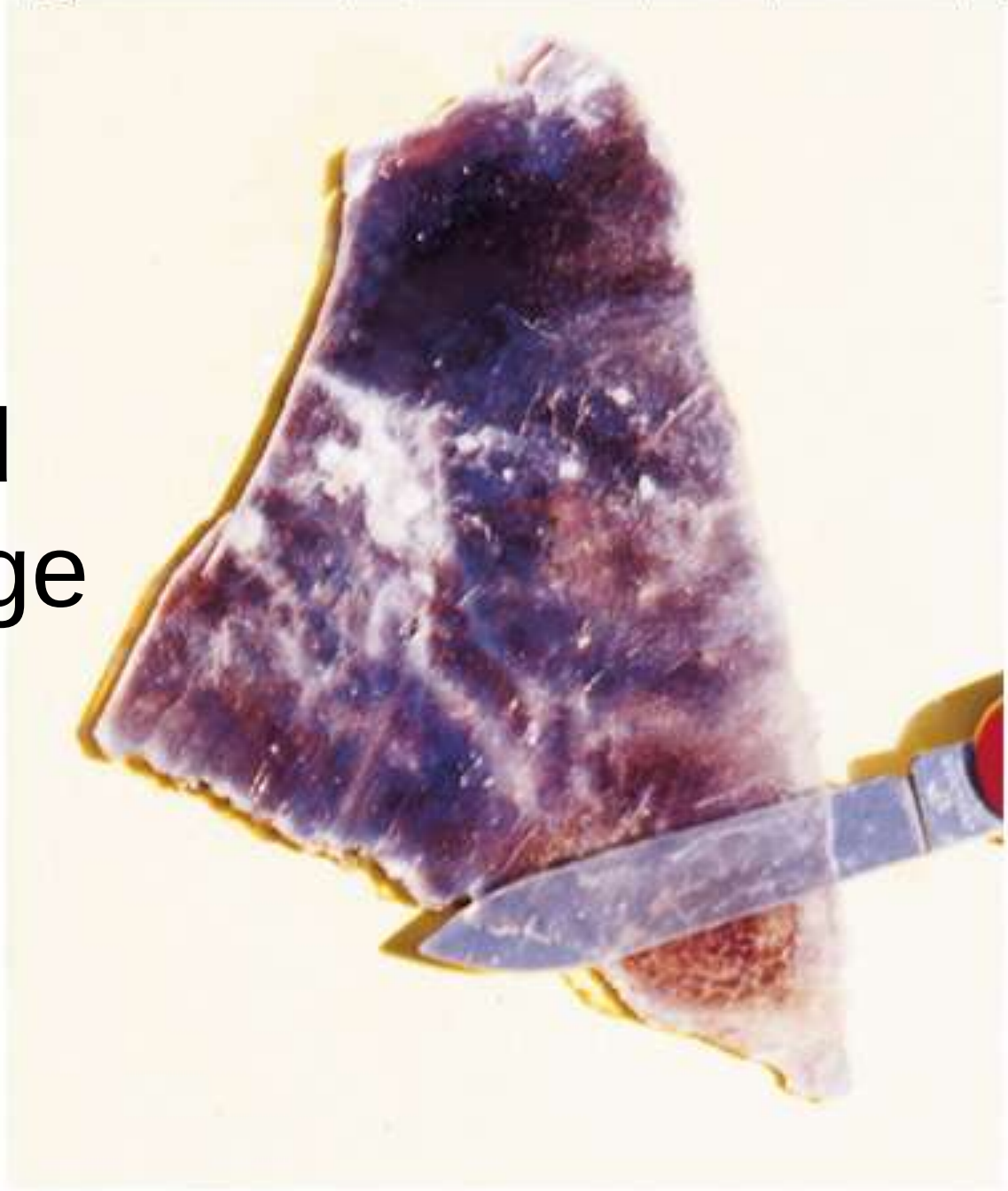
- Fracture = the way a substance breaks when it is not controlled by cleavage – irregular surfaces (not planes)

cleavage

- Cleavage

The internal atomic arrangement of a mineral allows for the tendency of a mineral to split along certain preferred directions. Cleavage is the ability of a mineral to break, when struck, along preferred directions

Mica – layered cleavage

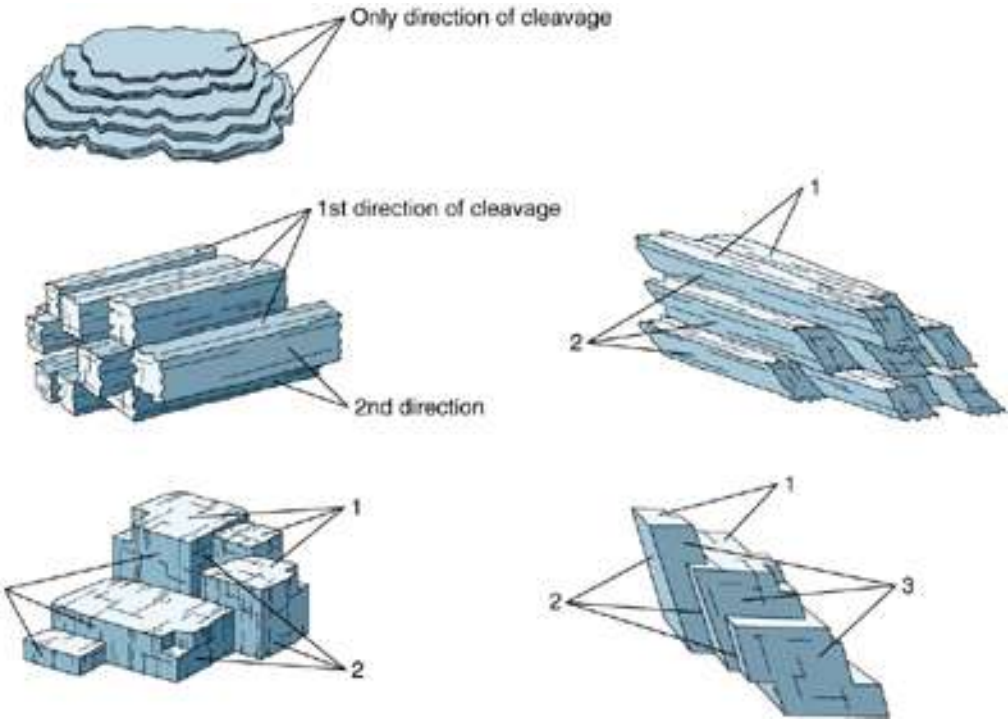


A

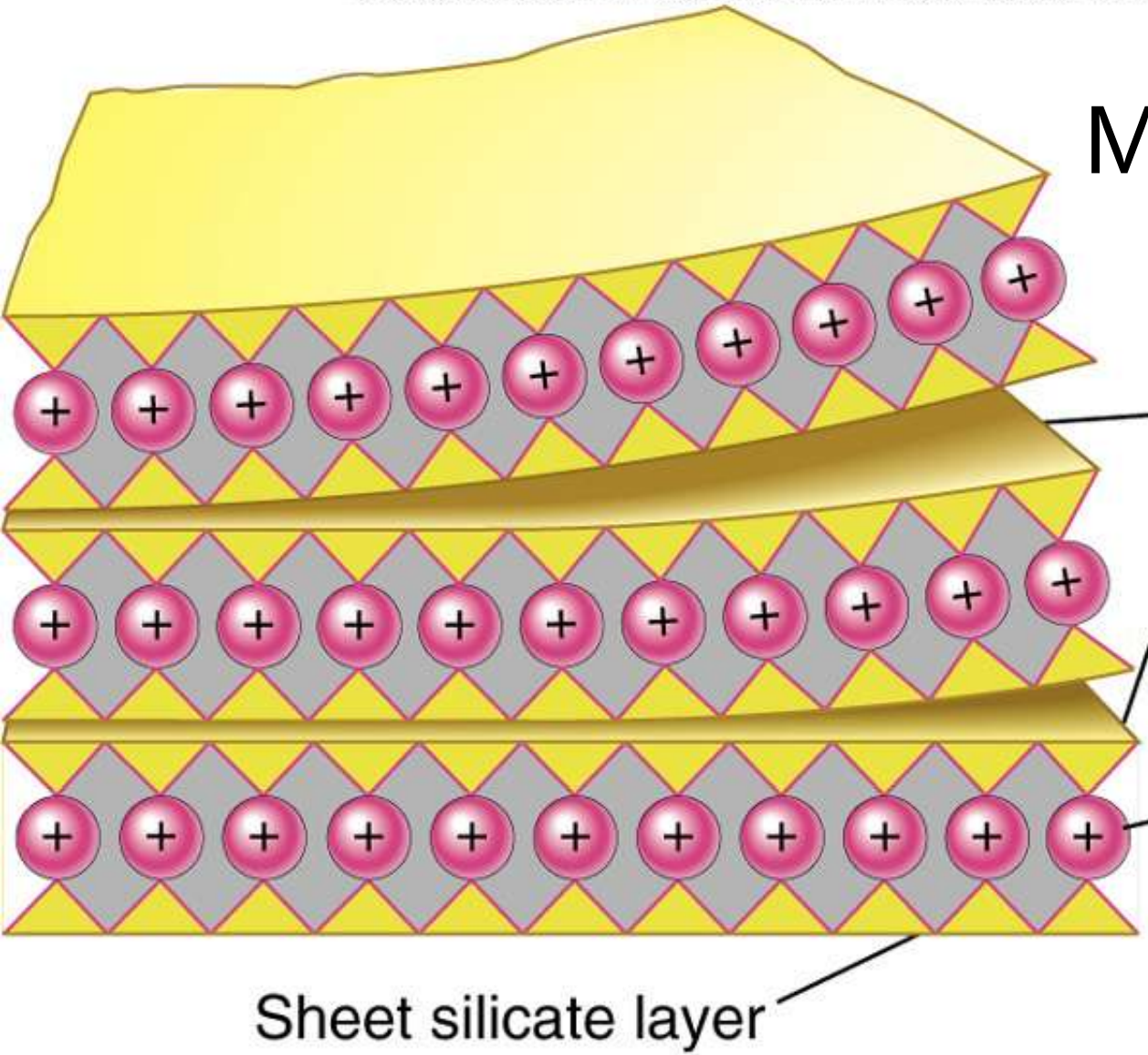
Photo by C. C. Plummer

Mineral Properties

- **Cleavage**
  - Breakage *along flat planes*
  - ***stairsteps***
  - ***Reflections from several flat at same time – like mirrors***



Mica structure

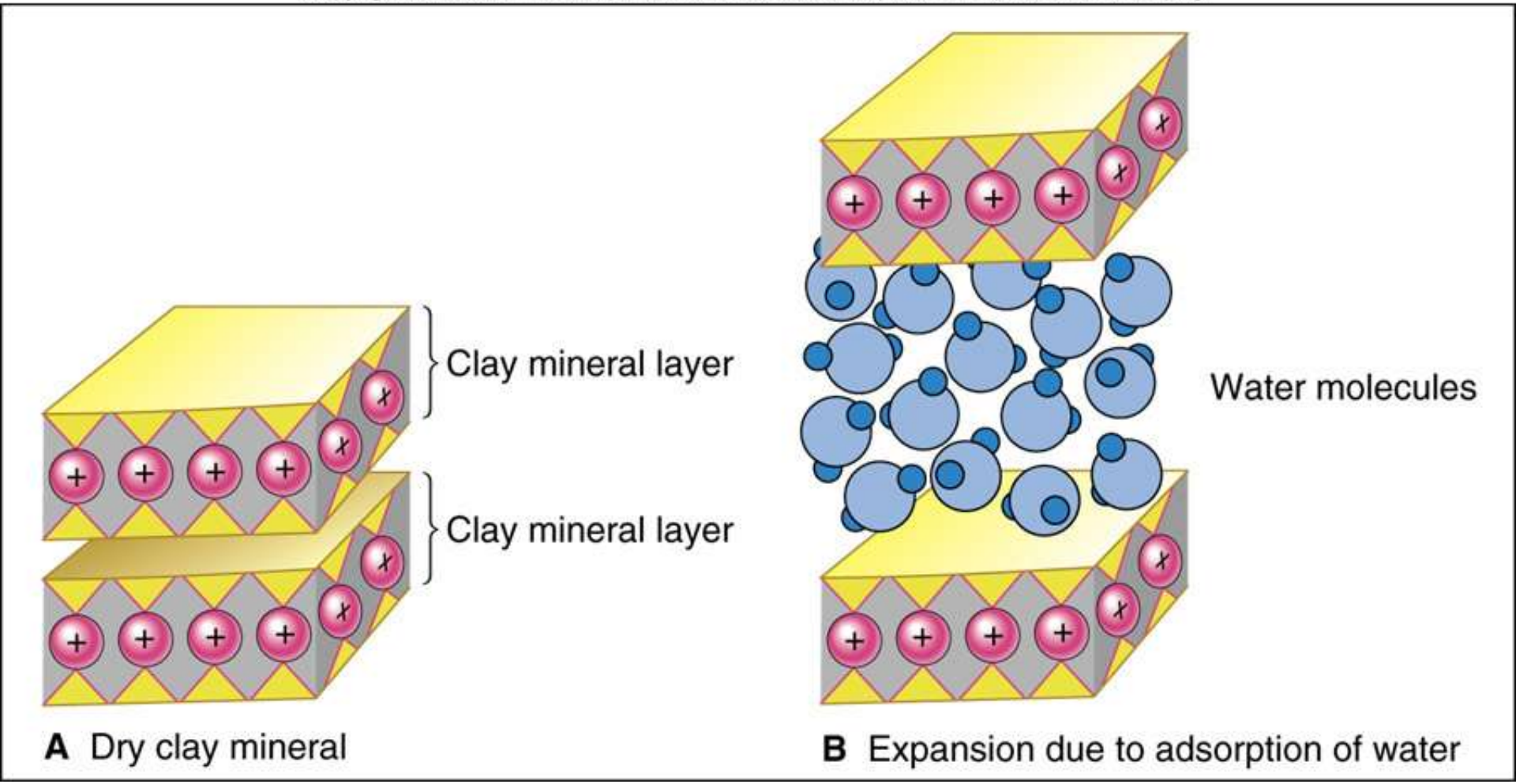


Because of weak bonds, mica splits easily between "sandwiches"

Positive ions, sandwiched between two sheet silicate layers

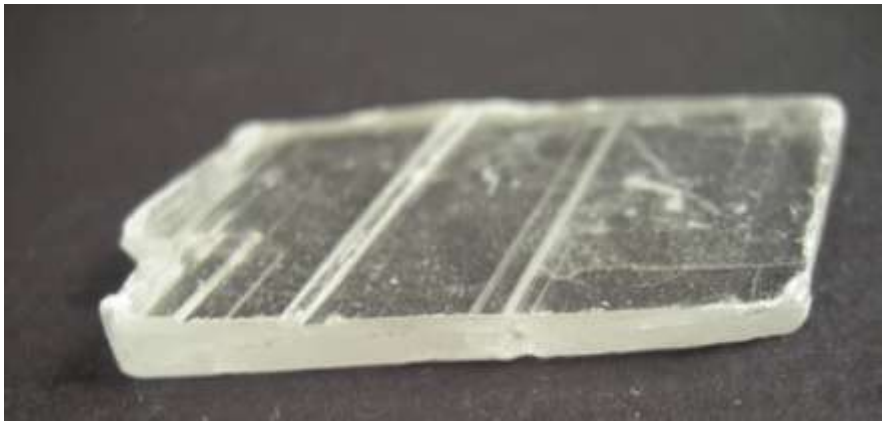
Sheet silicate layer

B

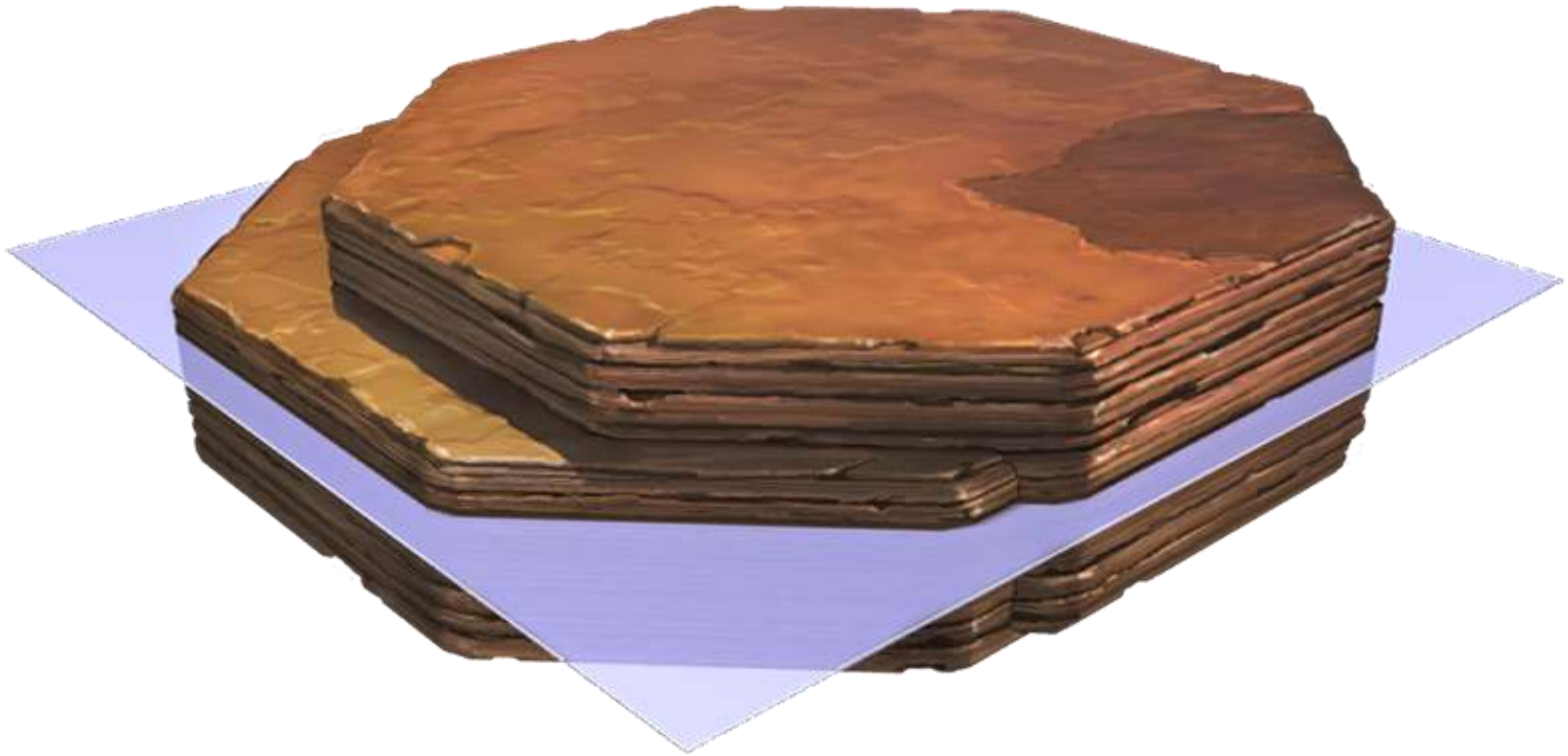


graphite – layered cleavage

Cleavage in 1 direction - layers

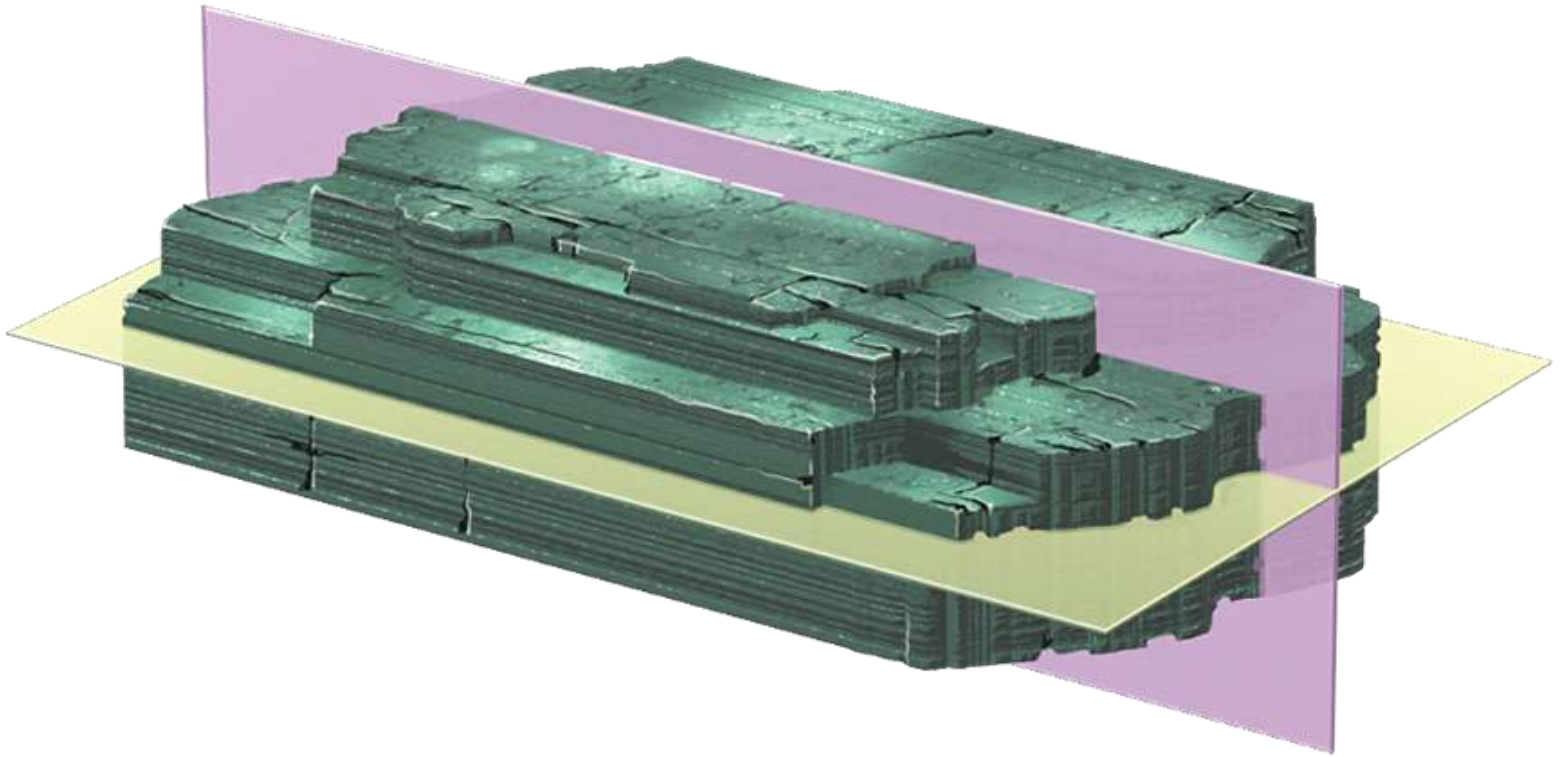


Cleavage in 1 direction



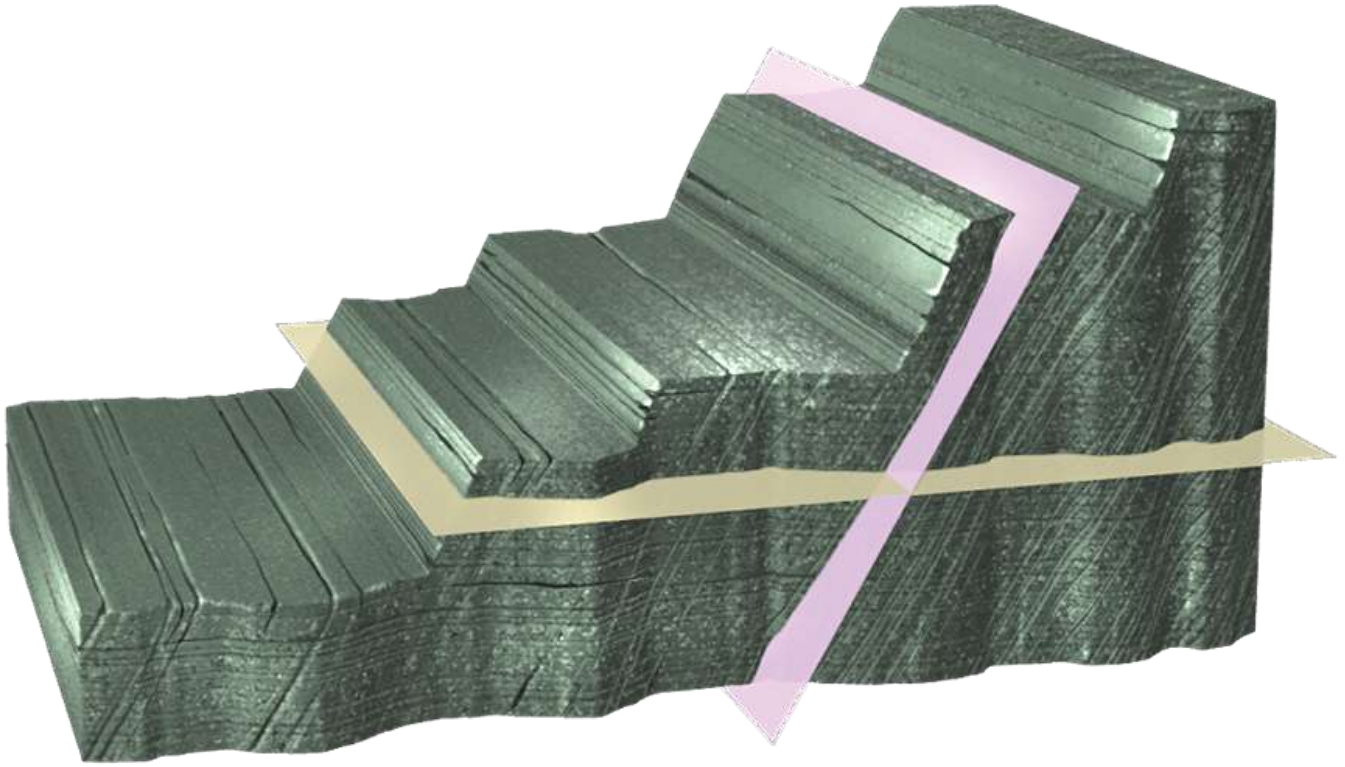
Biotite – 1 direction cleavage

Cleavage in 2 directions - 90



Cleavage in 2 directions

Cleavage – 2 directions 120/60



Cleavage, fracture

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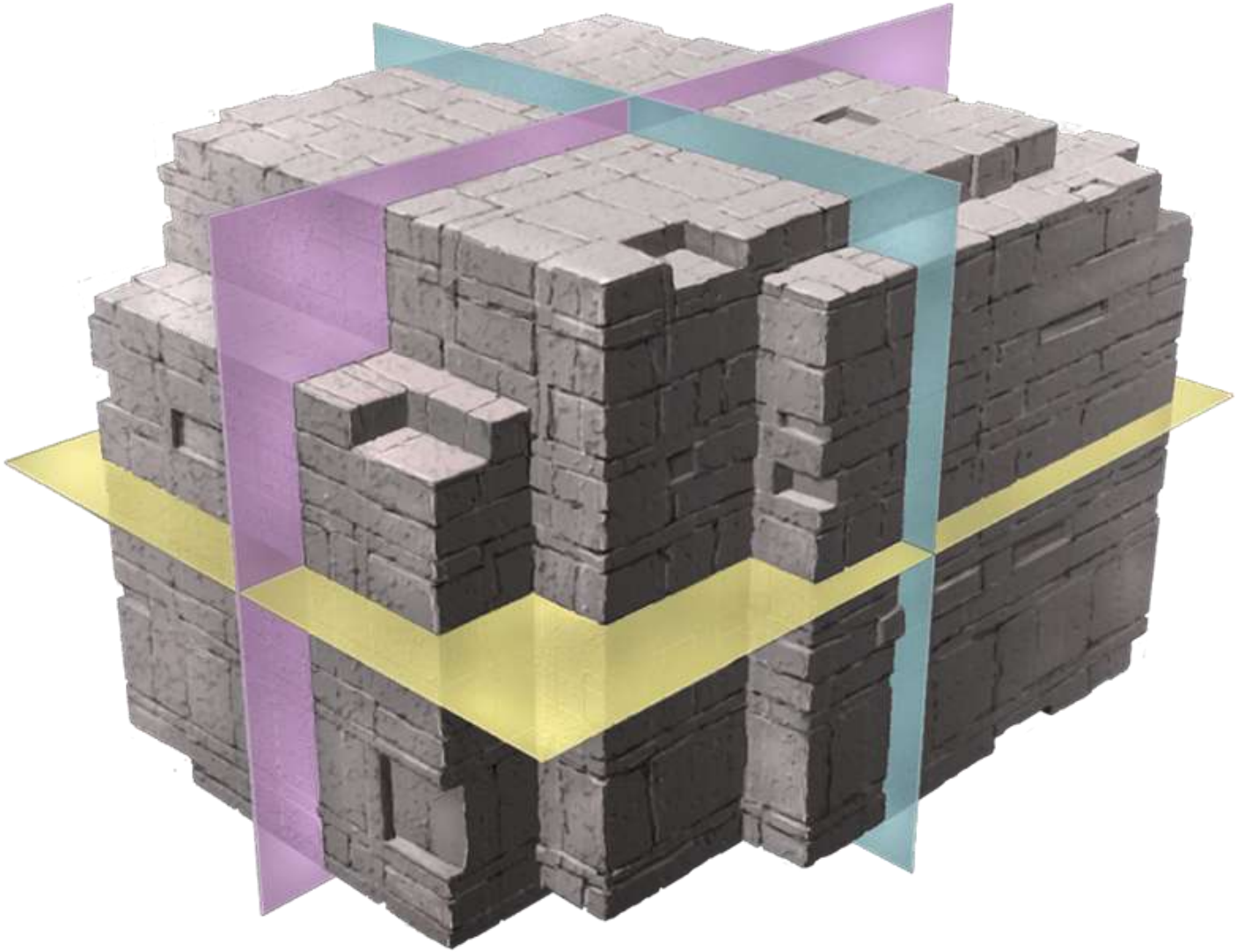
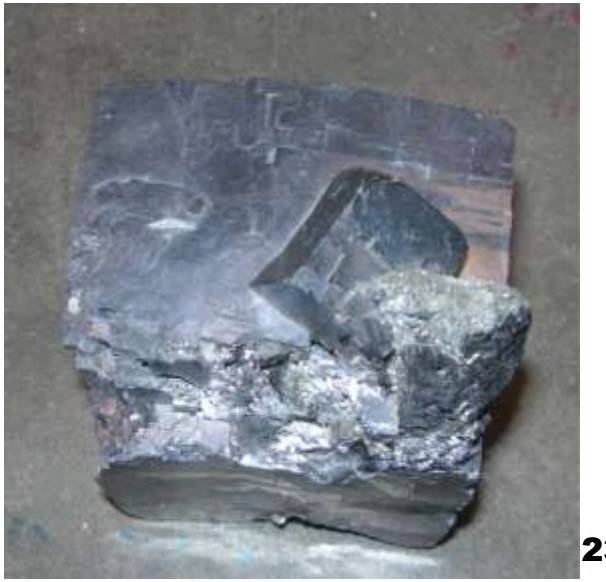
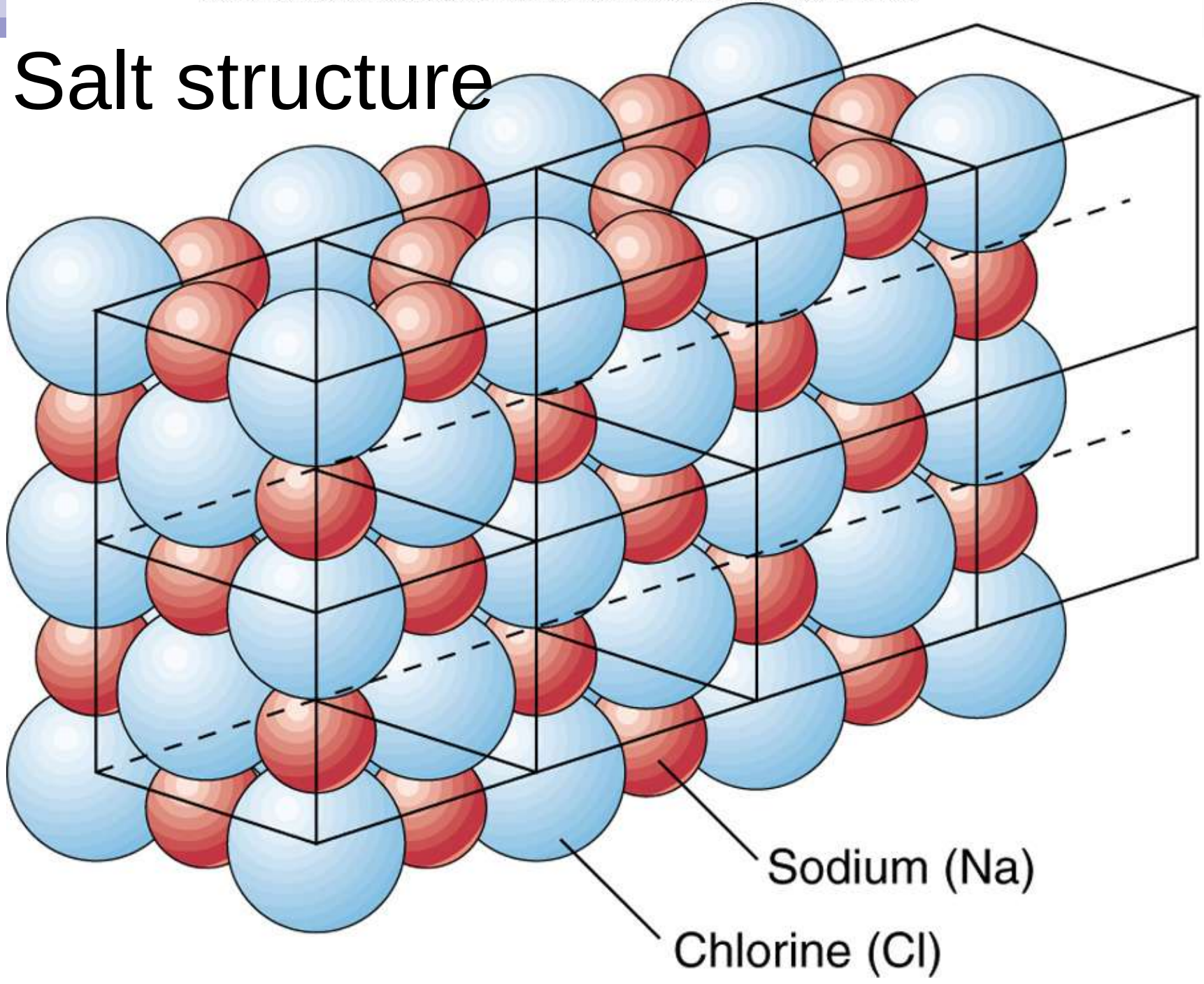
Cleavage in 3 directions - cubic

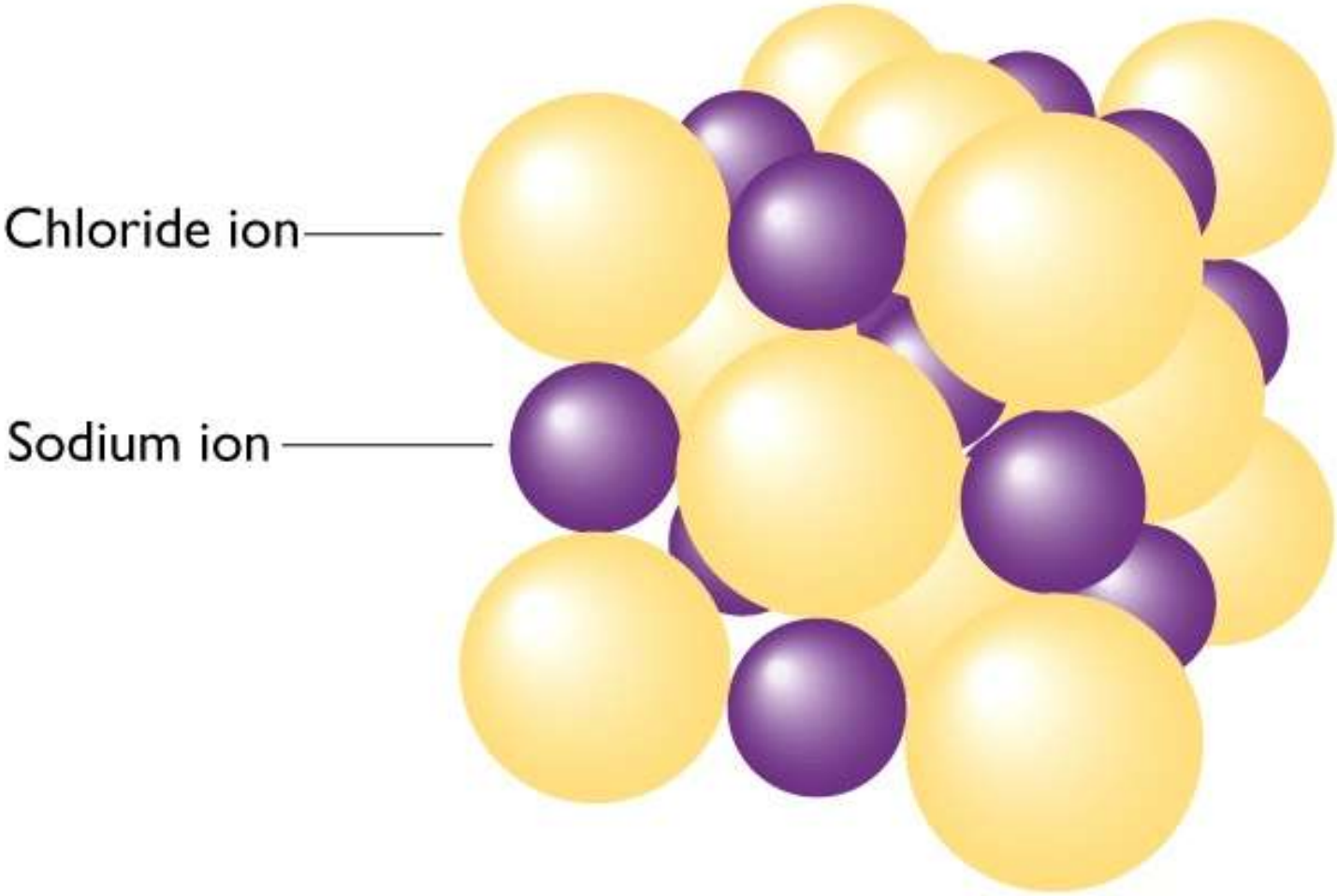


Cleavage in 3 directions - cubic



Salt structure





- Halite, a chloride

Cleavage in 3 directions - rhombohedral

cleavage

Photo by C. C. Plummer

Cleavage in 4 directions - octahedral

Fluorite – octahedral cleavage

Cleavage in more than 4 directions

- sphalerite

Mineral Properties

- **Fracture**
  - *Irregular* breakage
    - ***Conchoidal fractures : volcanic glasses***
    - ***Irregular surfaces – no simultaneous reflections***

Conchoidal fracture

Mineral *Properties*

- **Hardness**
  - Scratch-resistance
  - **Mohs' hardness scale**

Photo by C. C. Plummer

Mohs hardness scale

Table 2.3

Mohs' Hardness Scale

1. Talc
2. Gypsum
   Fingernail
3. Calcite
   Copper coin
4. Fluorite
5. Apatite
   Knife blade
   Glass
6. Feldspar
   File
7. Quartz
8. Topaz
9. Corundum
10. Diamond

Mineral *Properties*

- **Color**
  - ***Visible*** tint
  - Poor identifier

Figs. 2.14, 2.15, pg 39

streak

- Color of a pulverized substance
- Obtained from rubbing a mineral on an unglazed porcelain tile
- Ex. - distinctive reddish brown streak - hematite

streak

- Color of a pulverized substance
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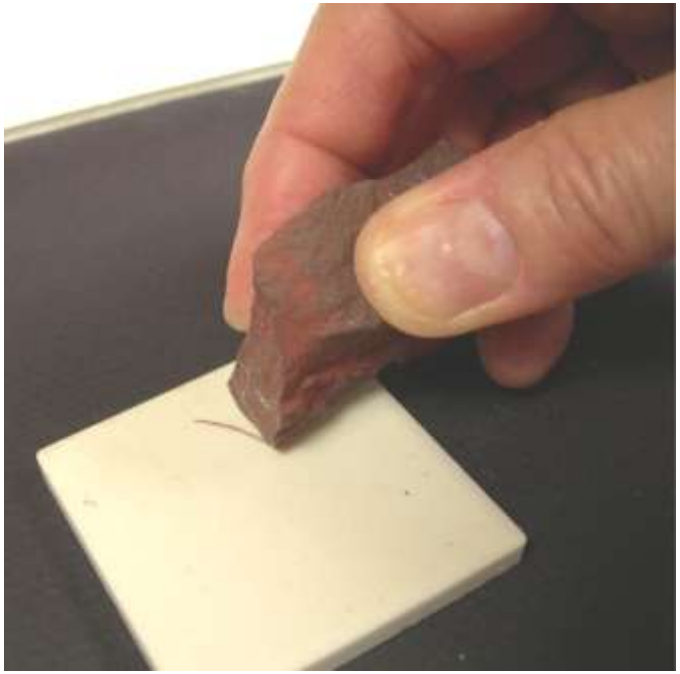
Mineral *Properties*

- **Streak**
  - Smear when scraped on unglazed porcelain
  - Color of powdered mineral
  - Most silicates have no streak – especially if harder than streak plate (7)



Mineral *Properties*

- **Crystal form**
  - External geometric form

(b)

- Galena (lead sulfide) and halite (common salt, sodium chloride) have the same crystal structures; thus, similar forms and cleavages (*why might other properties differ?*)

External characteristics of crystals

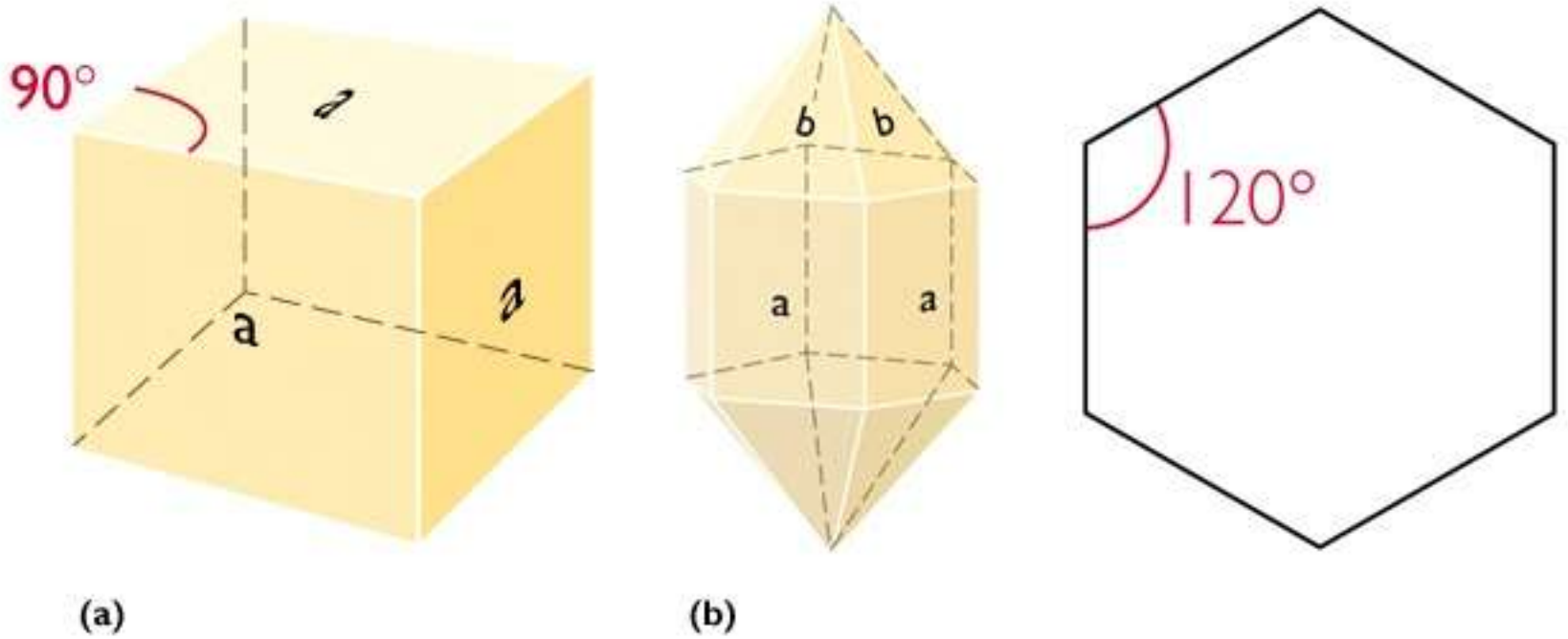
- Regular geometry of crystals — symmetry
  - Crystal “faces” (growth surfaces)
  - Physical properties (e.g., cleavage — planes of breaking)
- Both reflect the underlying crystal structure

Physical Properties of Minerals 2

- External Crystal Form

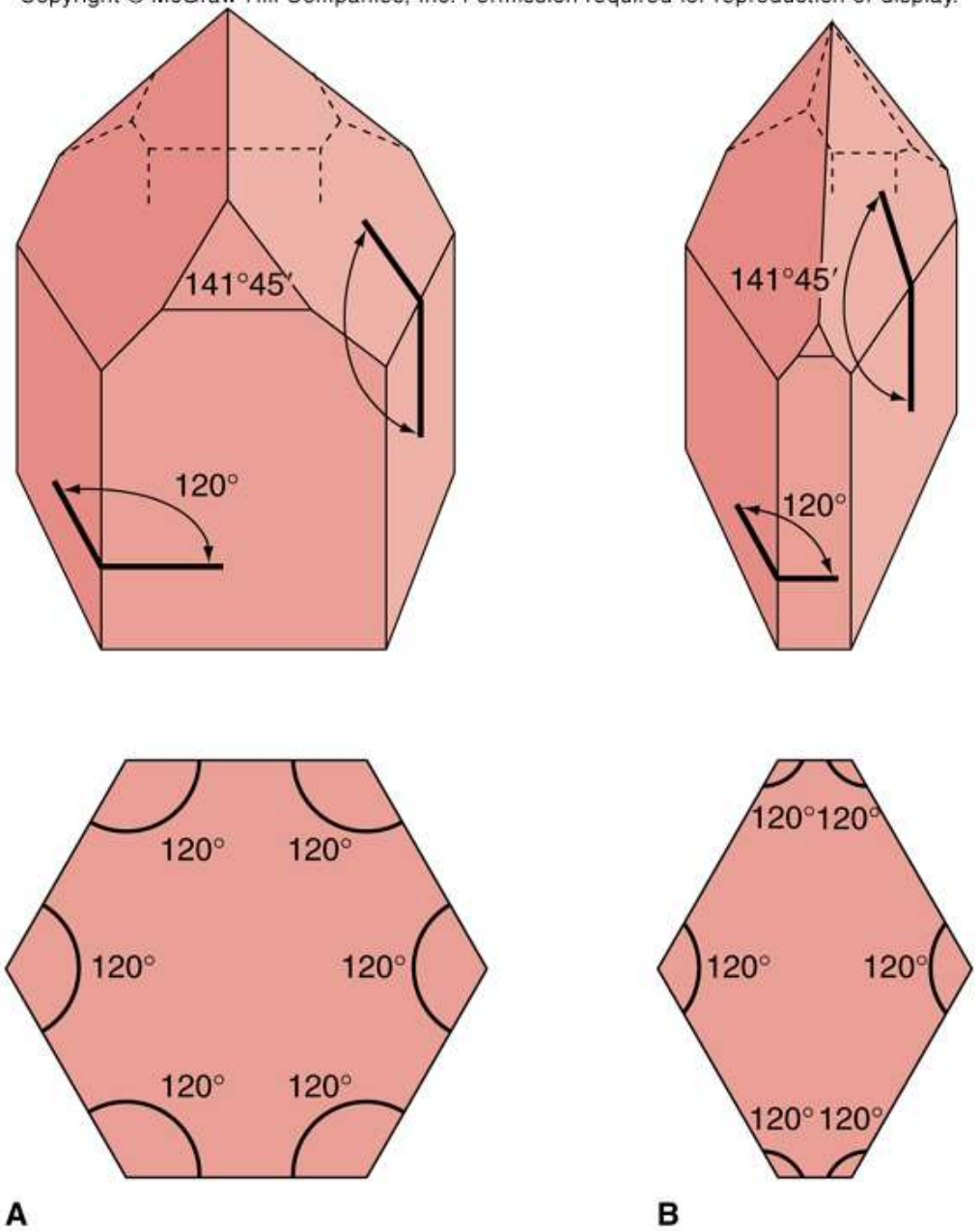
  The law of constancy of interfacial angles - minerals have sets of angles for adjacent faces that are consistent from sample to sample

  The essential orderly 3-dimensional stacking of tiny geometric forms



- Angular relationships are key distinguishing features--not relatives sizes, elongation, etc.
- Halite 90 degrees: cubic
- Quartz 120 degrees: hexagonal

Constancy of interfacial angles



A

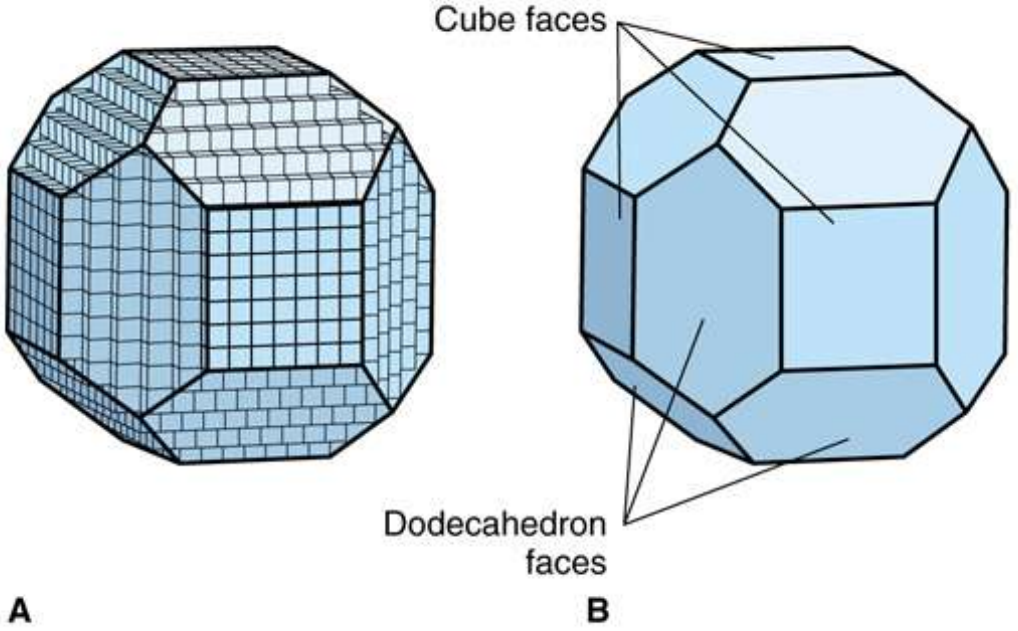
Photo by C. C. Plummer

B

Photo by C. C. Plummer

C

Photo by C. C. Plummer



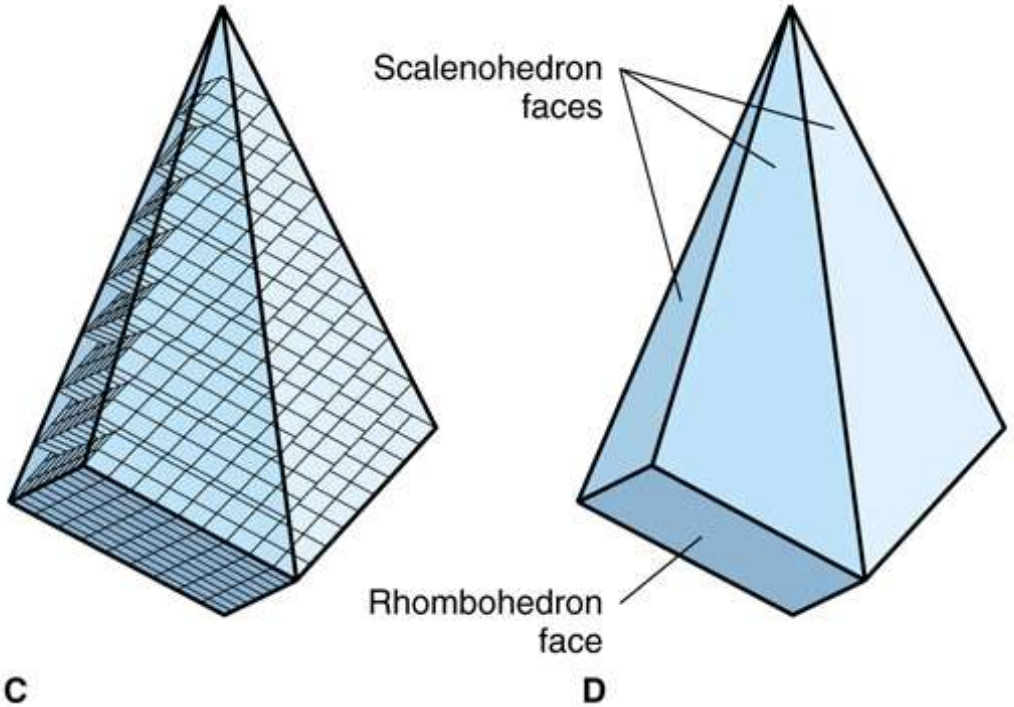
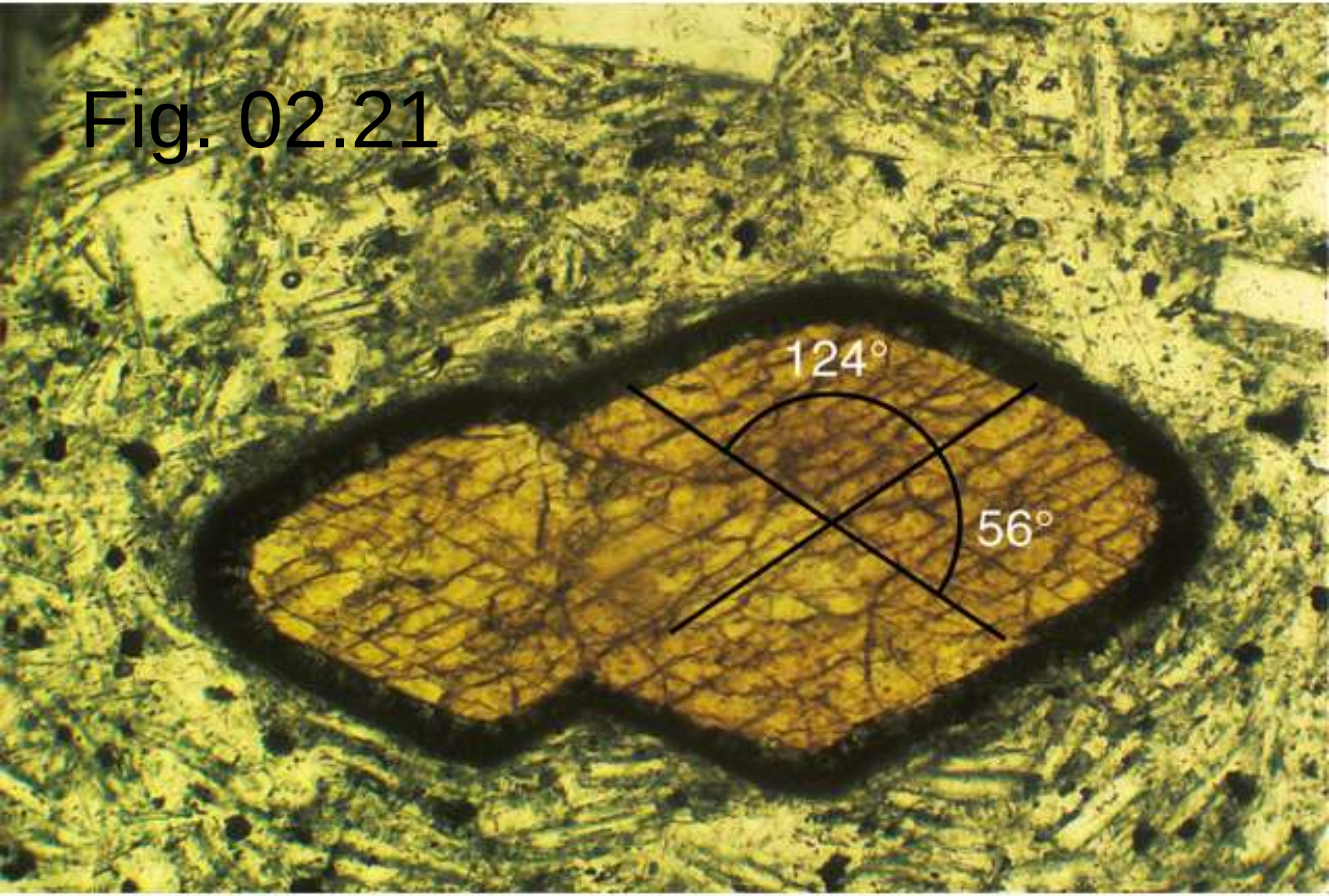


Fig. 02.21



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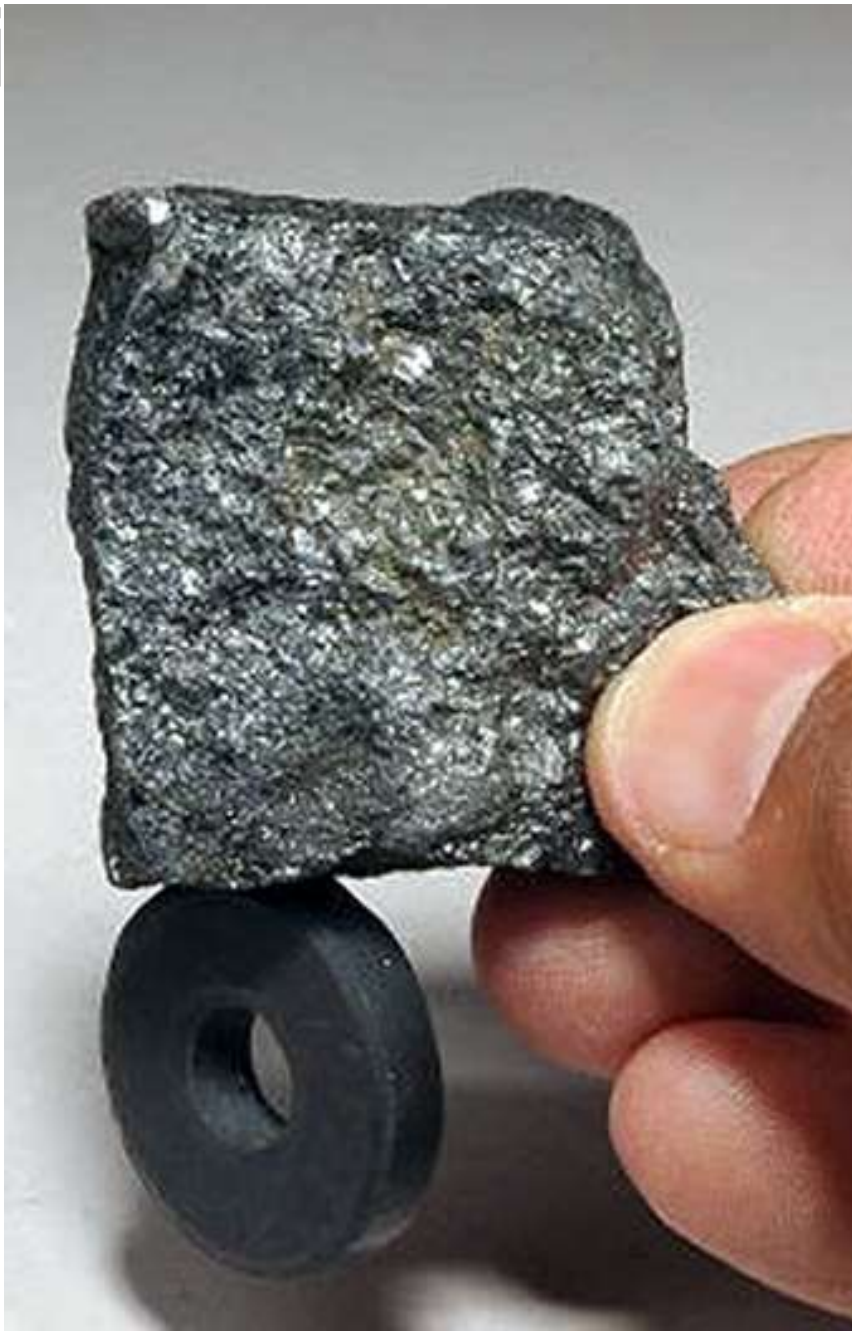
Physical Properties of Minerals 4

- Other Properties

  smell, taste, striations, magnetism, double refraction, x-ray diffraction, chemical

Mineral Properti

- **Magnetism**
  - Attracted to magnet



asbestos

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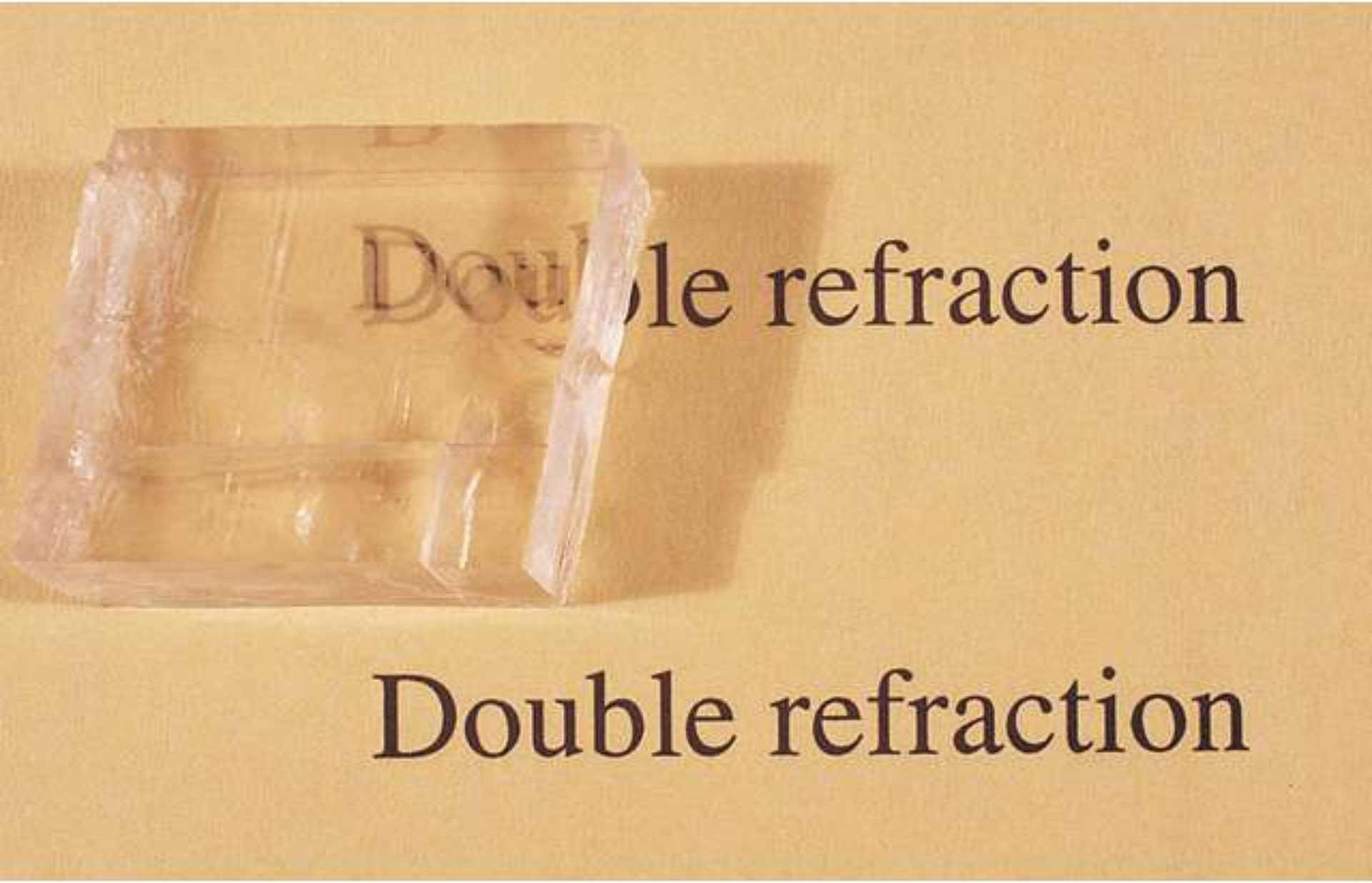


Double refraction

Photo by C. C. Plummer

Mineral *Properties*

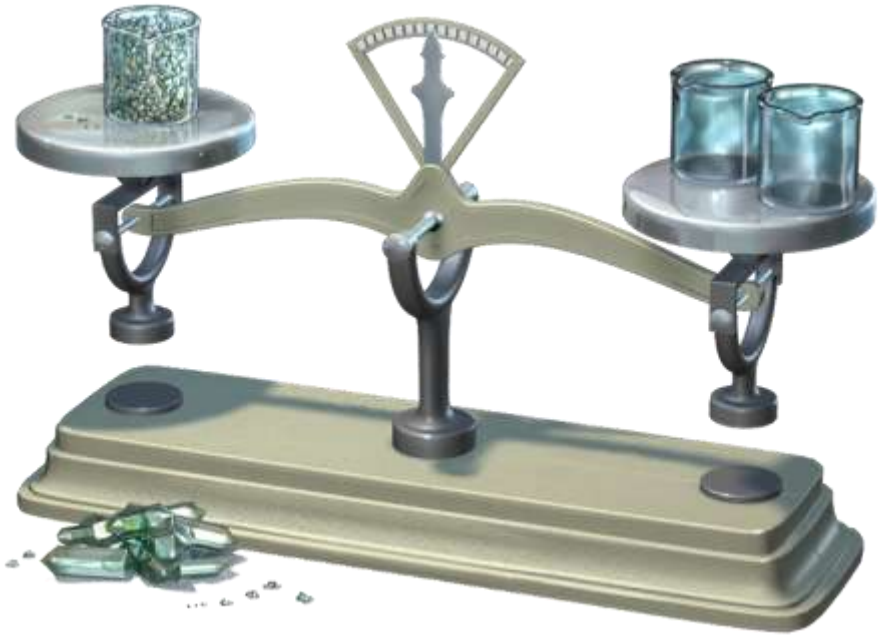
- **Color**
  - ***Visible*** tint
  - Poor identifier

Figs. 2.14, 2.15, pg 39

Physical Properties of Minerals 4

- Specific Gravity

  ratio of a mass of a substance to the mass of an equal volume of water (water=1.0, quartz=2.65, galena=7.5, gold=19.3)



Mineral Properties

- **Specific gravity**
  - Density *relative to water*
  - Quartz = 2.65; Gold = 19.3

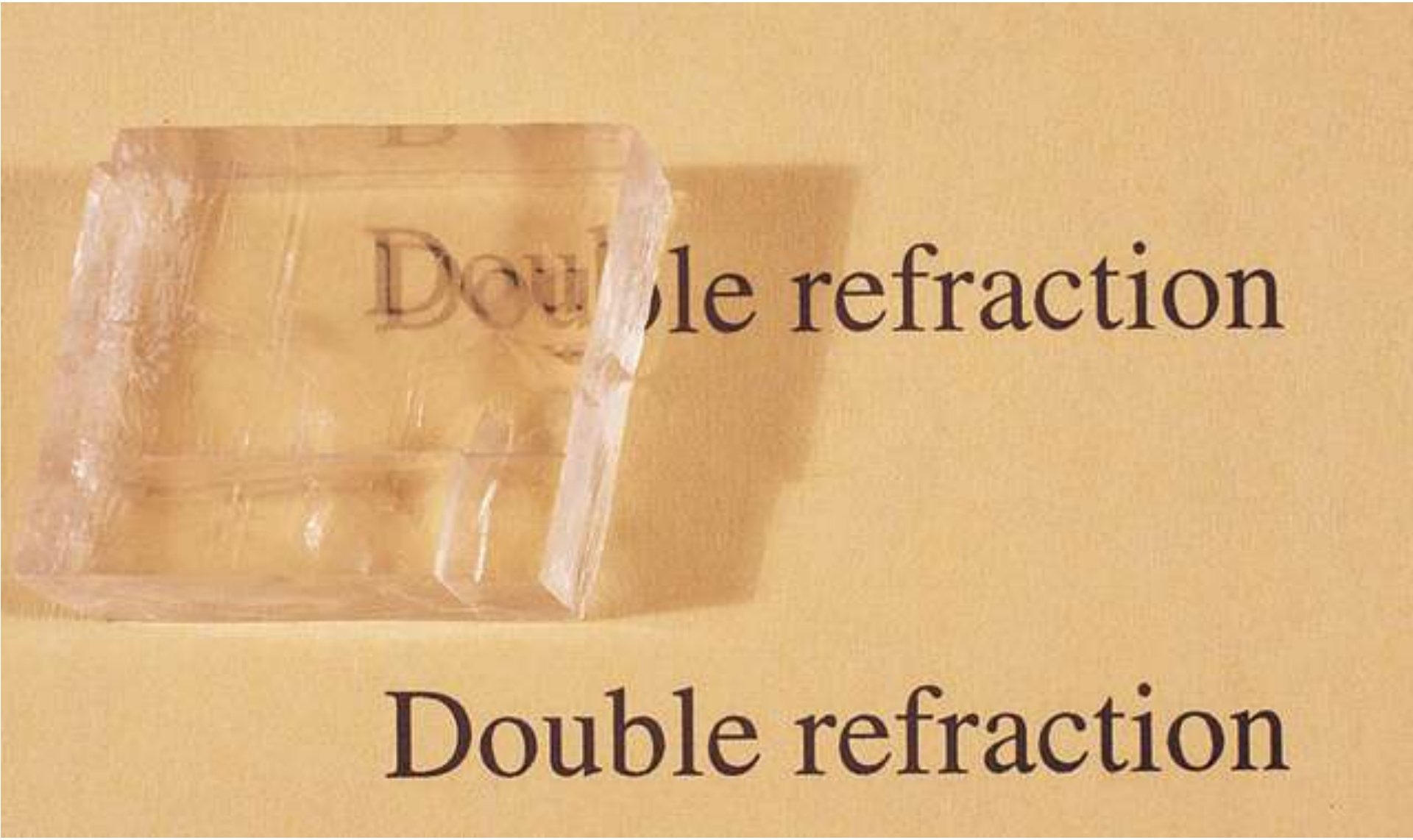
smell

Mineral Properties

- **Chemical reaction**
  - Calcite (& limestones)“fizz” in dilute HCl

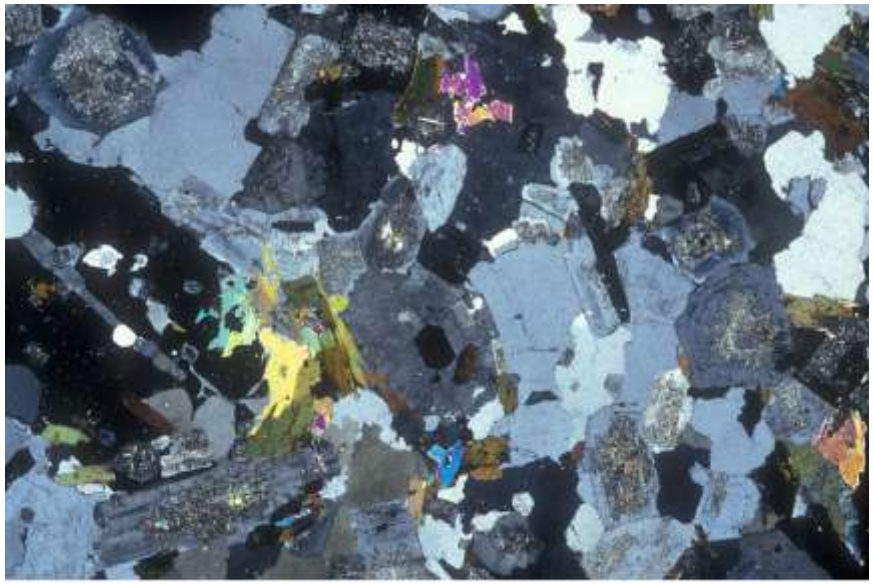
Calcite fizzes in dilute HCl

calcite



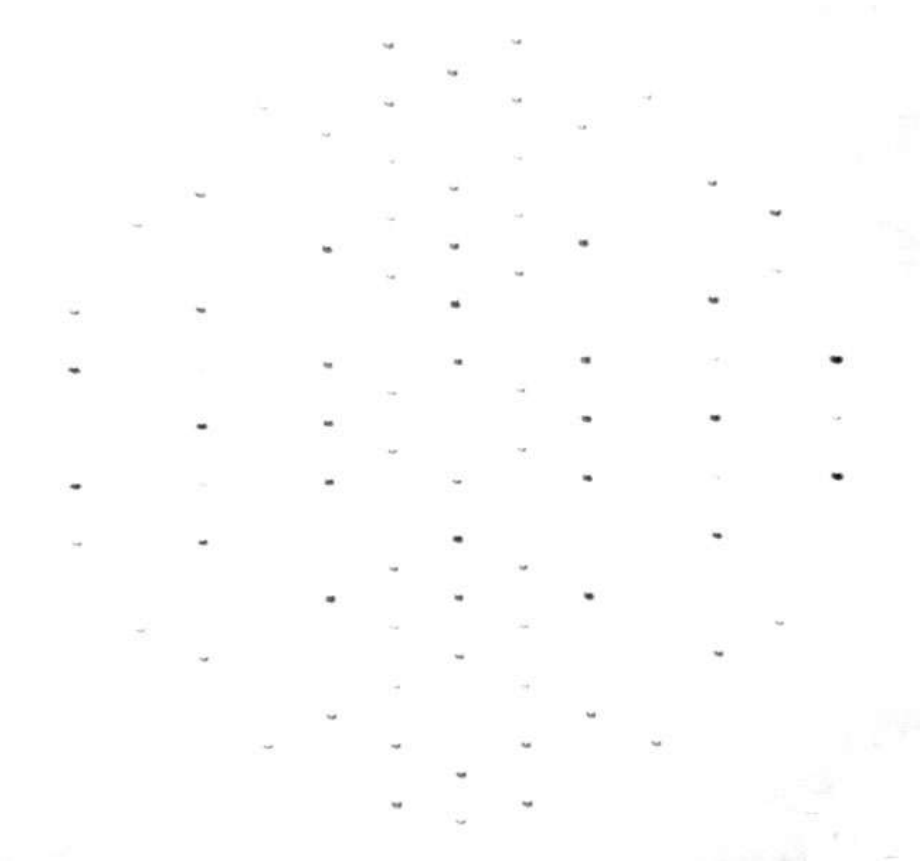
Scientific Tools for Mineral Identification and Study

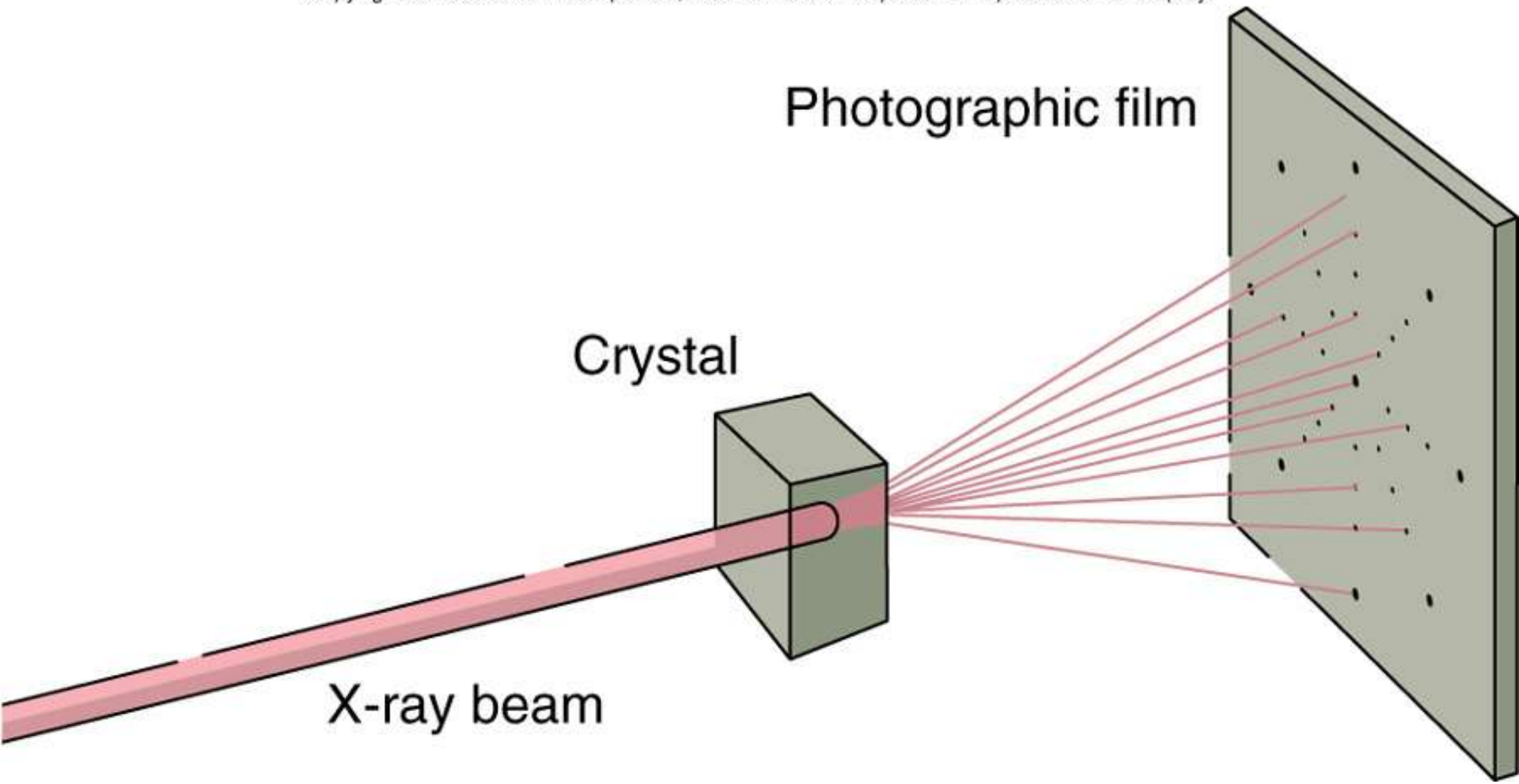
- Hand lens
- Petrographic microscope
- X-ray diffraction
- Electron microscopy
- Spectroscopy (infrared, visible)



Tools for Mineral Identification and Study

- Hand lens
- Petrographic microscope
- X-ray diffraction
- Electron microscopy
- Microbeam analysis
- Spectroscopy (infrared, visible)





Major classes of minerals

- Elements
- Sulfides – S
- Oxides – O
- Carbonates – CO_3
- Sulfates - SO_4
- Phosphates PO_4
- Silicates SiO_4