MADDE VE MİNERALLER

Minerallerin özellikleri

Minerallerin bileşimi

Figure 2.1 Native copper from Michigan's Keweenaw Peninsula. (Photo by E. J. Tarbuck)

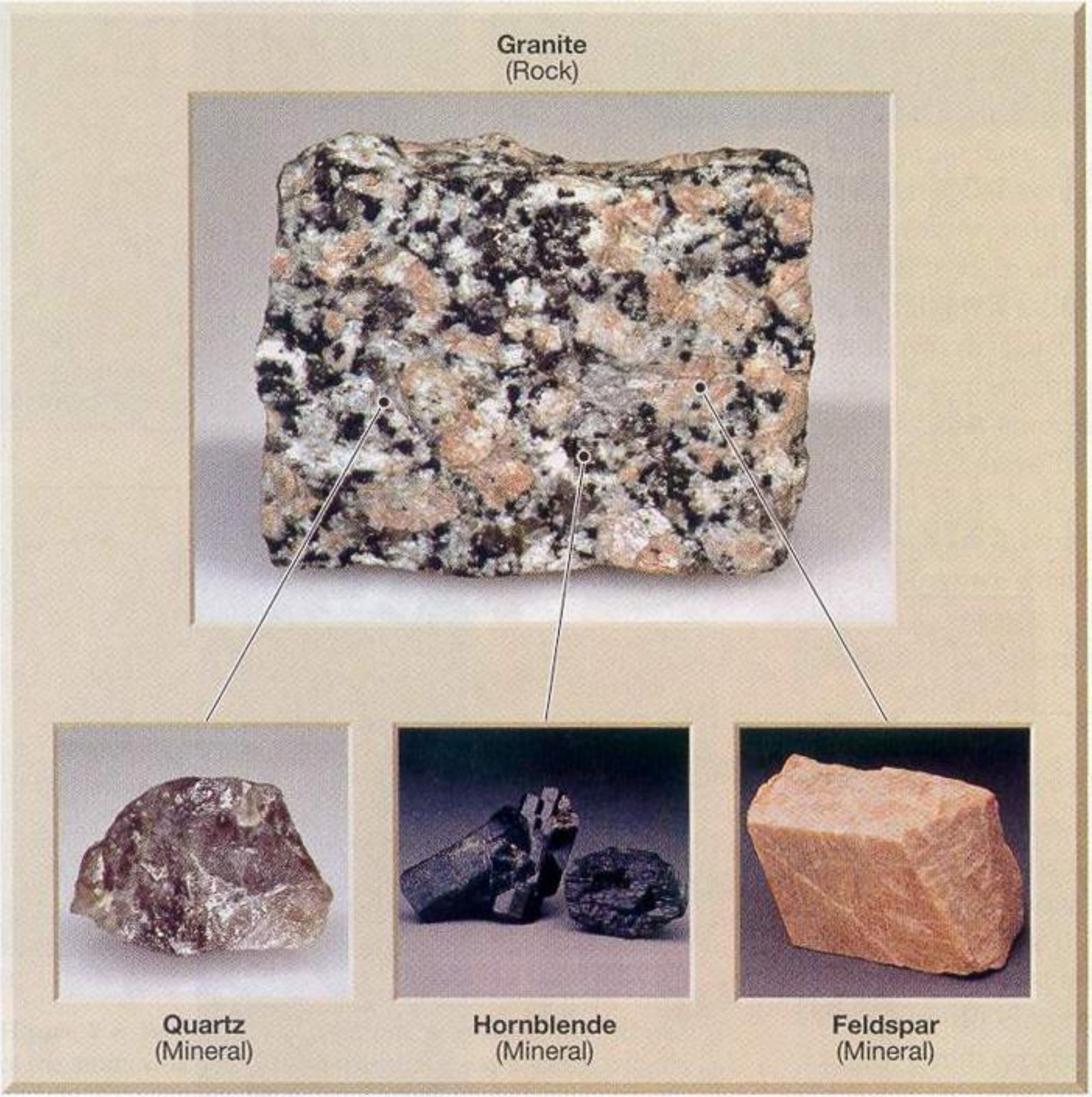


Figure 2.2 Most rocks are aggregates of several kinds of minerals.

*Atomun yapısı

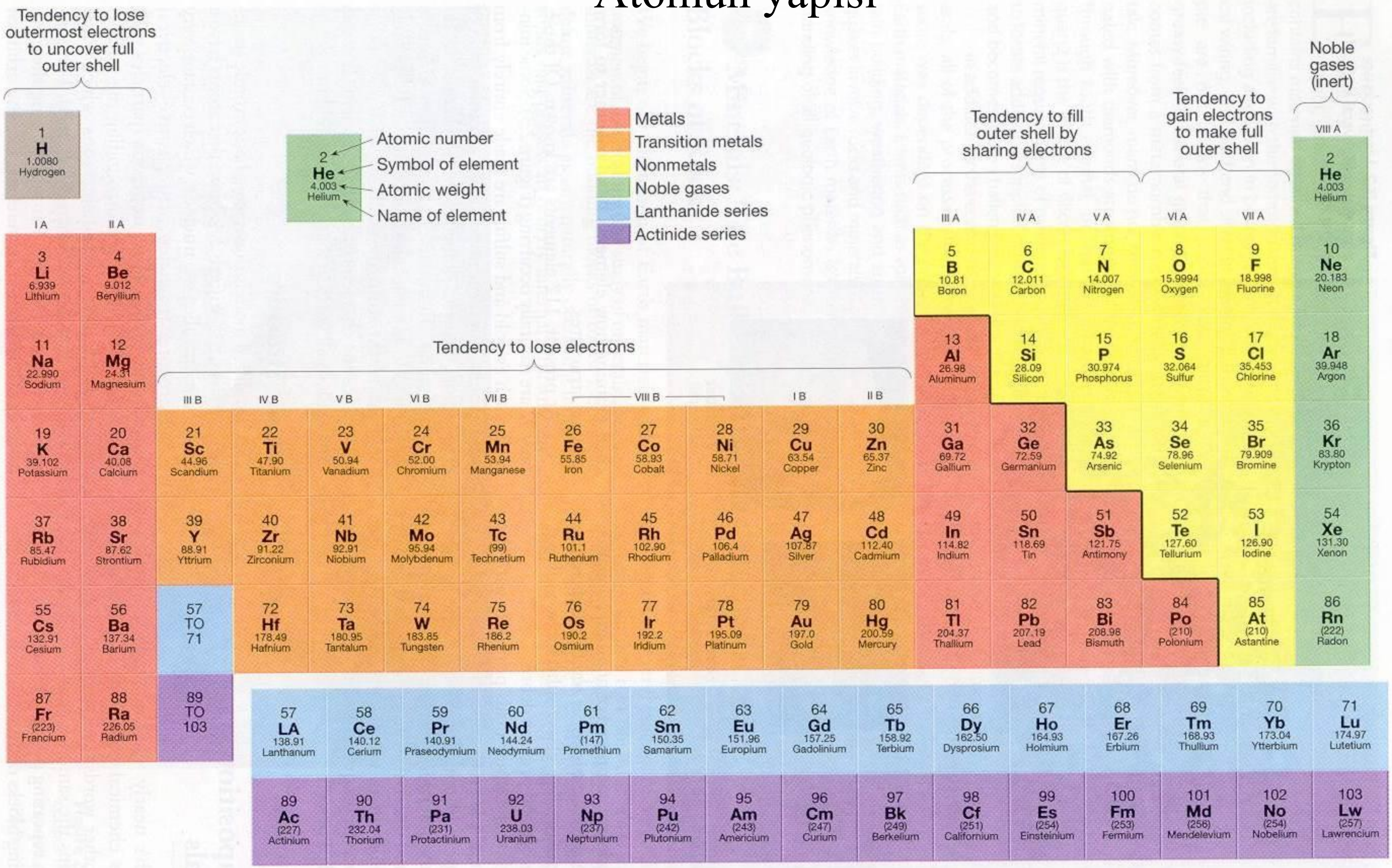


Figure 2.3 Periodic Table of the Elements.

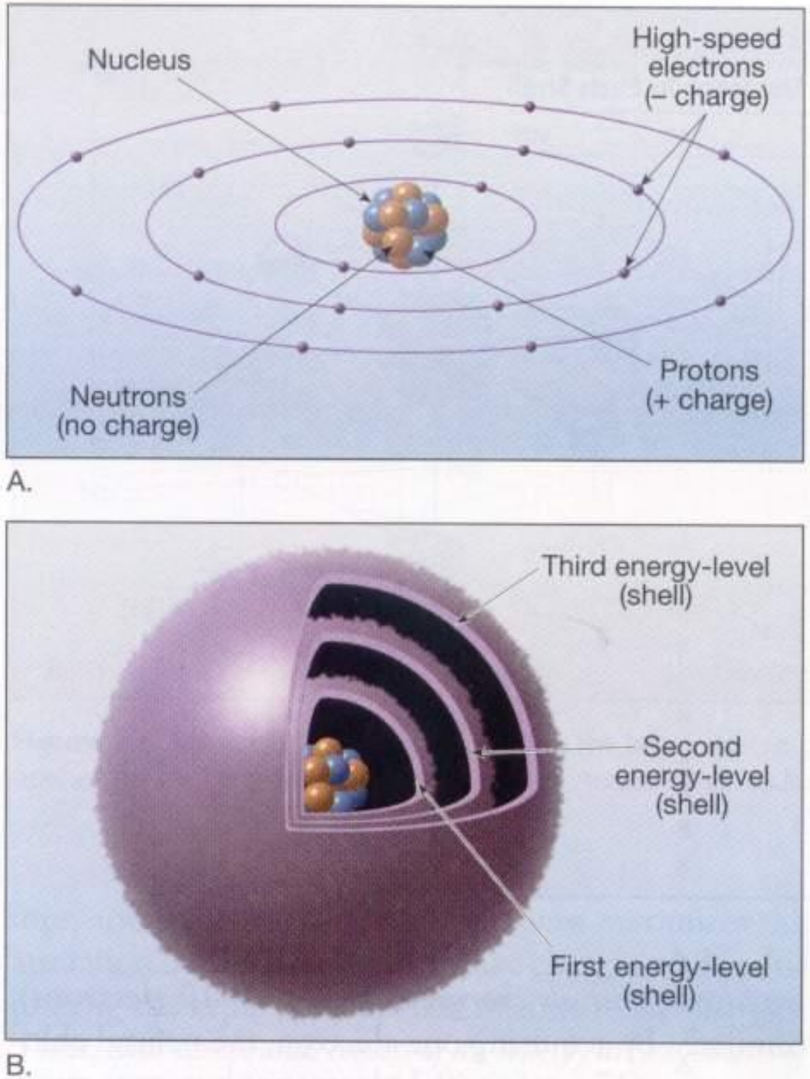


Figure 2.4 Two models of the atom. **A.** A very simplified view of the atom, which consists of a central nucleus, consisting of protons and neutrons, encircled by high-speed electrons. **B.** Another model of the atoms showing spherically shaped electron clouds (energy level shells). Note that these models are not drawn to scale. Electrons are minuscule in size compared to protons and neutrons, and the relative space between the nucleus and electron shells is much greater than illustrated.

Kimyasal Bağlar

- İyonik bağlar
- Kovalent bağlar
- Diğer bağlar

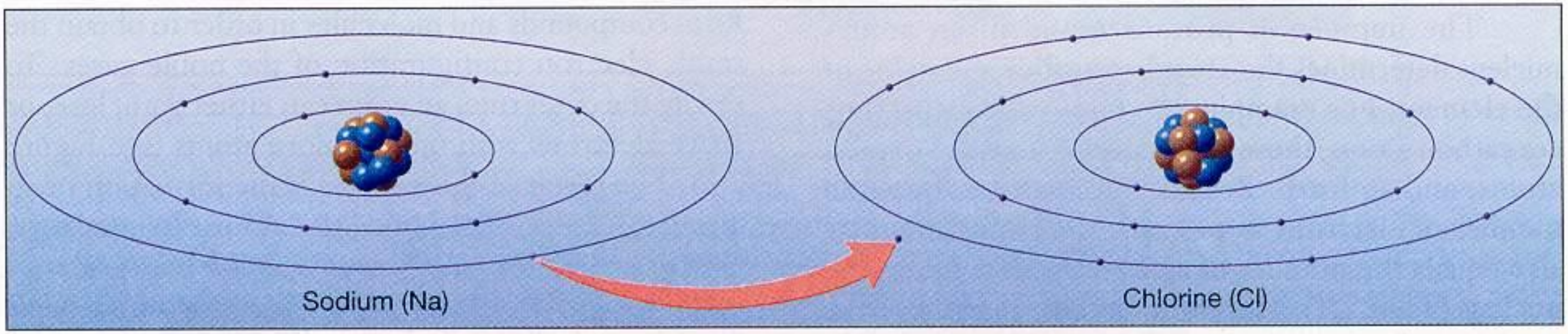


Figure 2.5 Chemical bonding of sodium and chlorine through the transfer of the lone outer electron from a sodium atom to a chlorine atom. The result is a positive sodium ion (Na^+) and a negative chloride ion (Cl^-). Bonding to produce sodium chloride (NaCl) is due to electrostatic attraction between the positive and negative ions. In this process note that both the sodium and chlorine atoms have achieved the stable noble gas configuration (eight electrons in their outer shell).

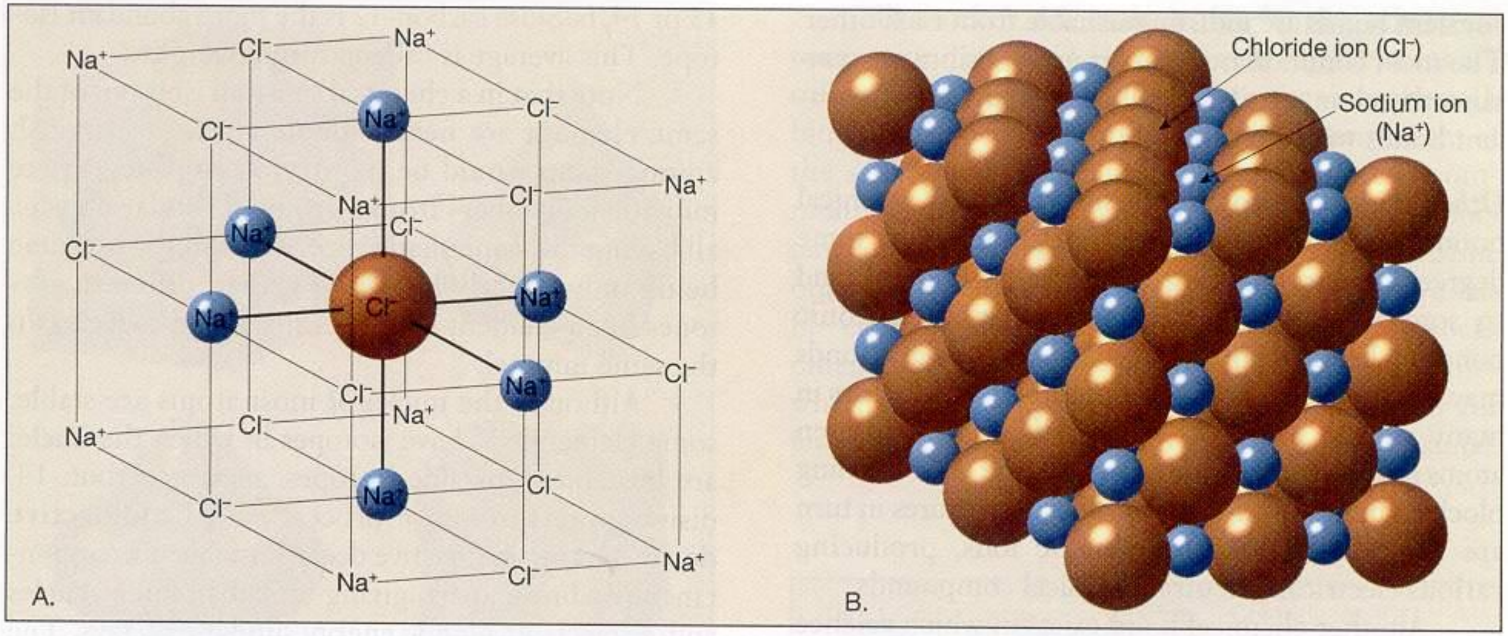


Figure 2.6 Schematic diagrams illustrating the arrangement of sodium and chloride ions in table salt. A. Structure has been opened up to show arrangement of ions. B. Actual ions are closely packed.

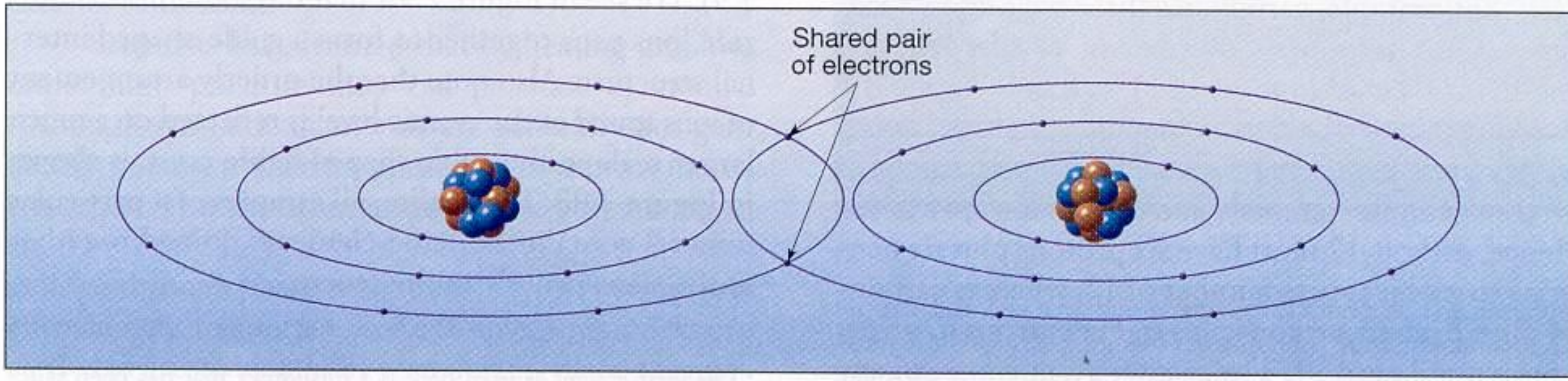


Figure 2.7 Illustration of the sharing of a pair of electrons between two chlorine atoms to form a chlorine molecule. Notice that by sharing a pair of electrons both chlorine atoms have eight electrons in their valence shell.

Minerallerin yapısı

*Polimorfizm

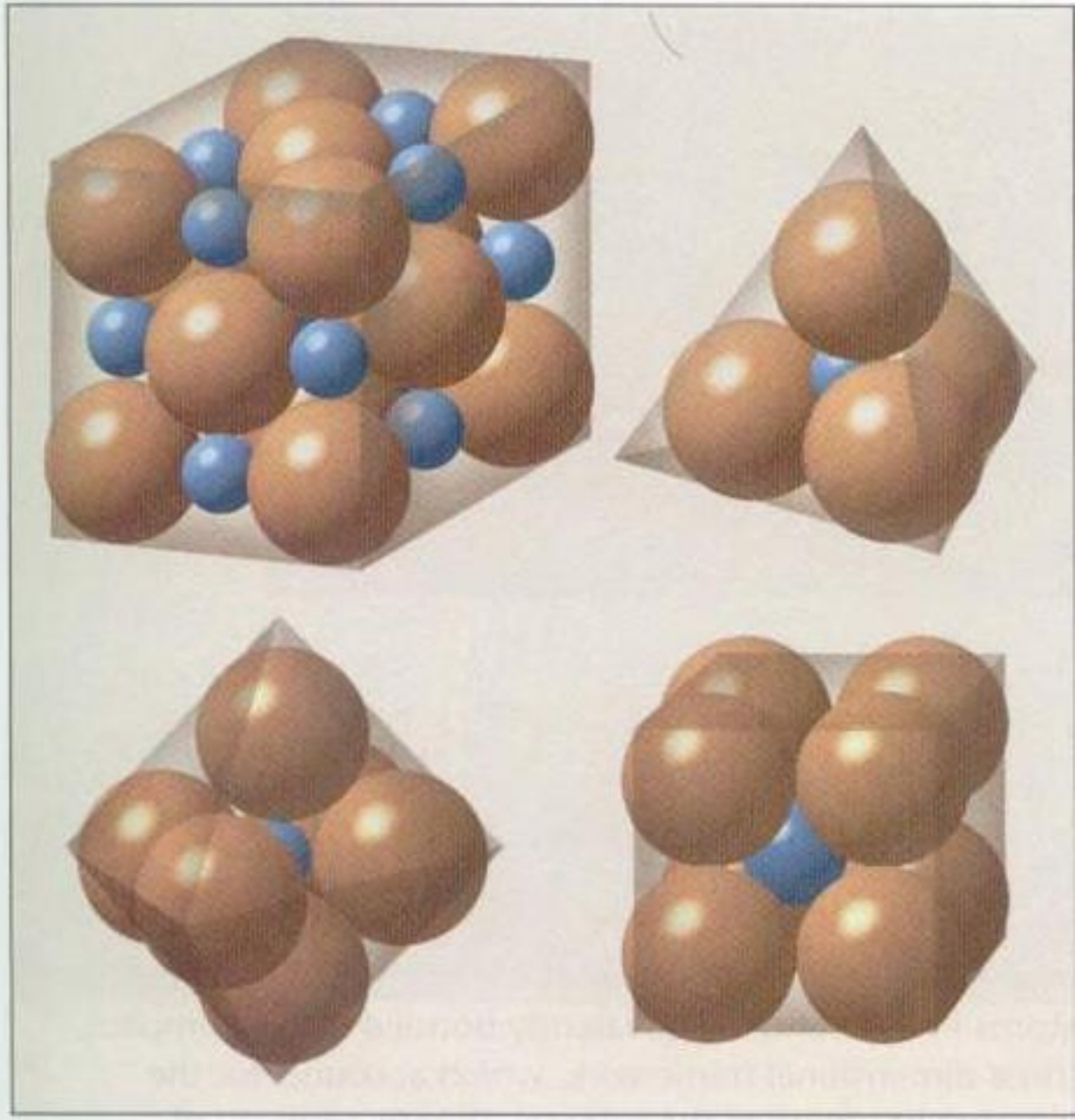
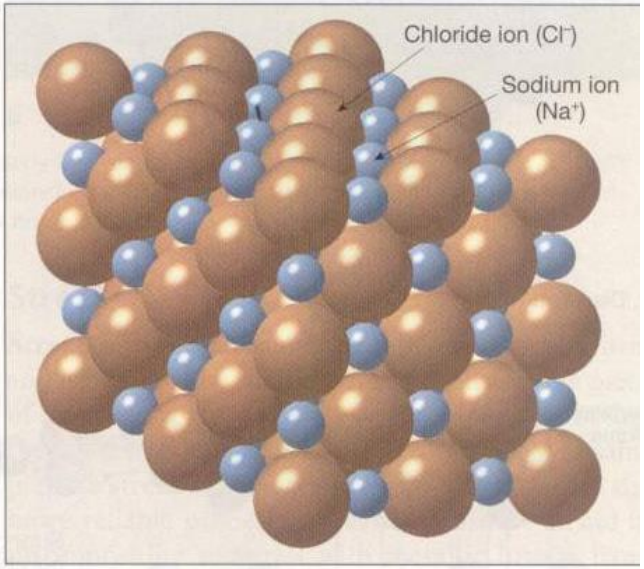


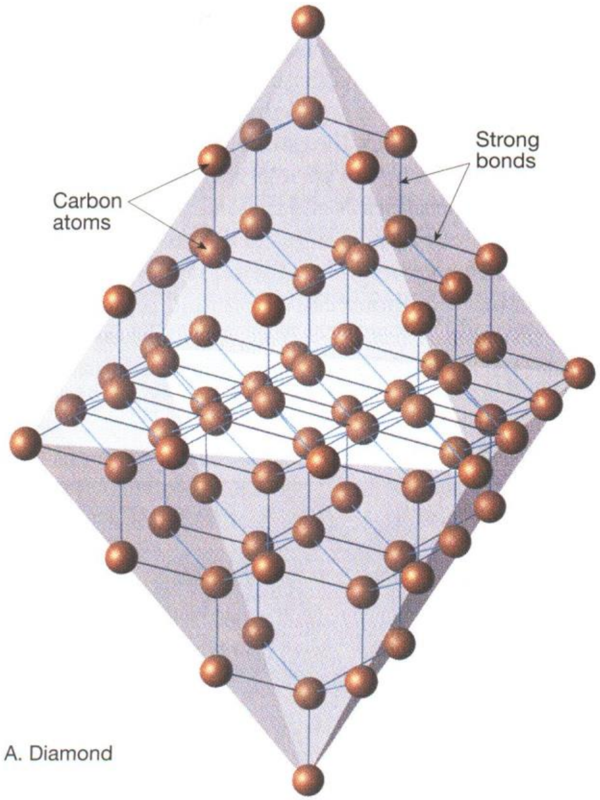
Figure 2.8 Ideal geometrical packing for various-sized positive and negative ions.



A.

B.

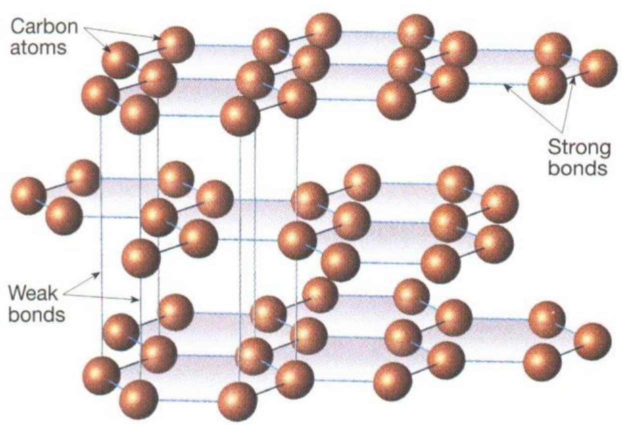
Figure 2.9 The structure of sodium chloride. **A.** The orderly arrangement of sodium and chloride ions in the mineral halite. **B.** The orderly arrangement at the atomic level produces regularly shaped crystals.



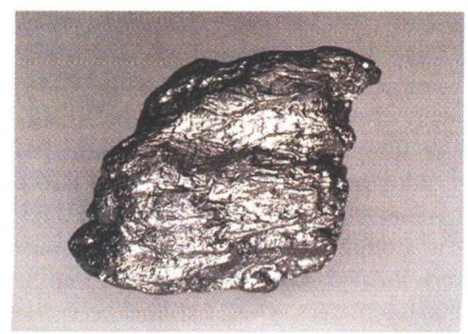
A. Diamond

A. Diamond

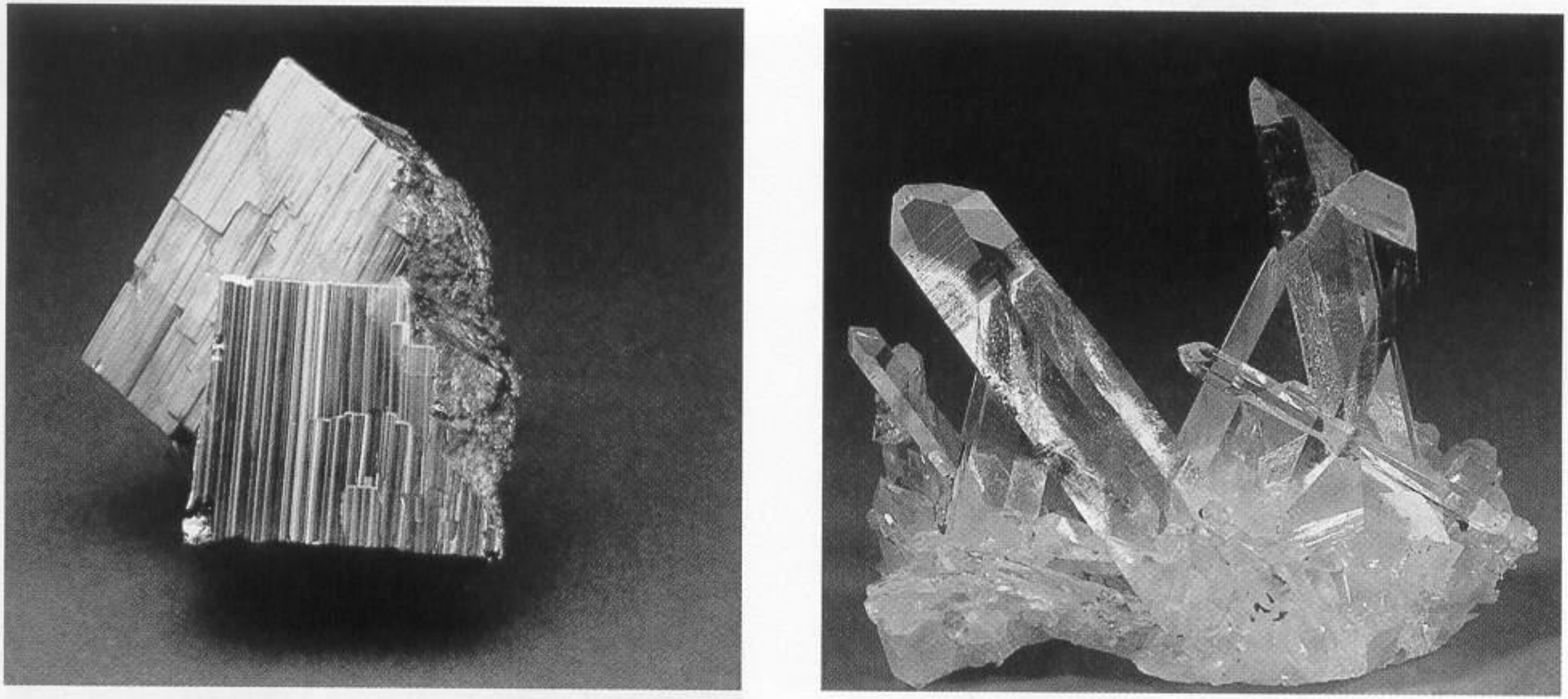
Figure 2.10 Comparing the structures of diamond and graphite. Both are natural substances with the same chemical composition—carbon atoms. Nevertheless, their internal structure and physical properties reflect the fact that each formed in a very different environment. **A.** All carbon atoms in diamond are covalently bonded into a compact, three-dimensional framework, which accounts for the extreme hardness of the mineral. (Photo courtesy of Smithsonian Institution) **B.** In graphite the carbon atoms are bonded into sheets that are joined in a layered fashion by very weak electrical forces. These weak bonds allow the sheets of carbon to readily slide past each other, making graphite soft and slippery, and thus useful as a dry lubricant. (Photo by E. J. Tarbuck)



B. Graphite



B. Graphite



A. B.

Figure 2.11 Crystal form is the external expression of a mineral's orderly internal structure. **A.** Pyrite, commonly known as "fool's gold," often forms cubic crystals. They may exhibit parallel lines (striations) on the faces. **B.** Quartz sample that exhibits well-developed hexagonal crystals with pyramidal-shaped ends. (Photo by Breck P. Kent)

Minerallerin Fiziksel Özellikleri

Kristal şekli, Parlaklık, renk, çizgi rengi, sertlik, dilinim, kırınım, özgül ağırlık

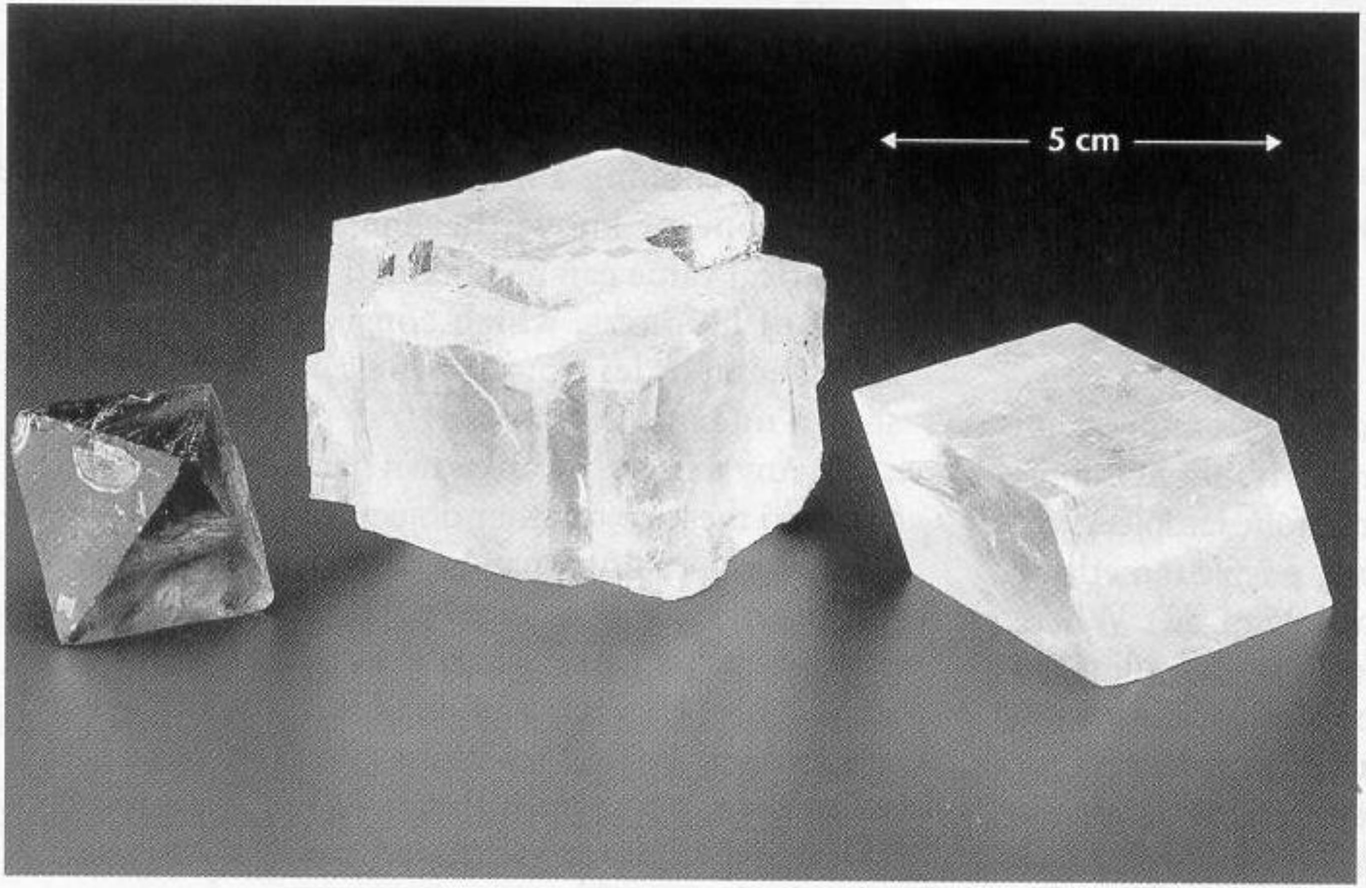


Figure 2.13 Smooth surfaces produced when a mineral with cleavage is broken. The sample on the left (fluorite) exhibits four planes of cleavage (eight sides), whereas the other two samples exhibit three planes of cleavage (six sides). Also notice that the mineral in the center (halite) has cleavage planes that meet at 90° angles, whereas the mineral on the right (calcite) has cleavage planes that meet at 75° angles. (Photo by E. J. Tarbuck)

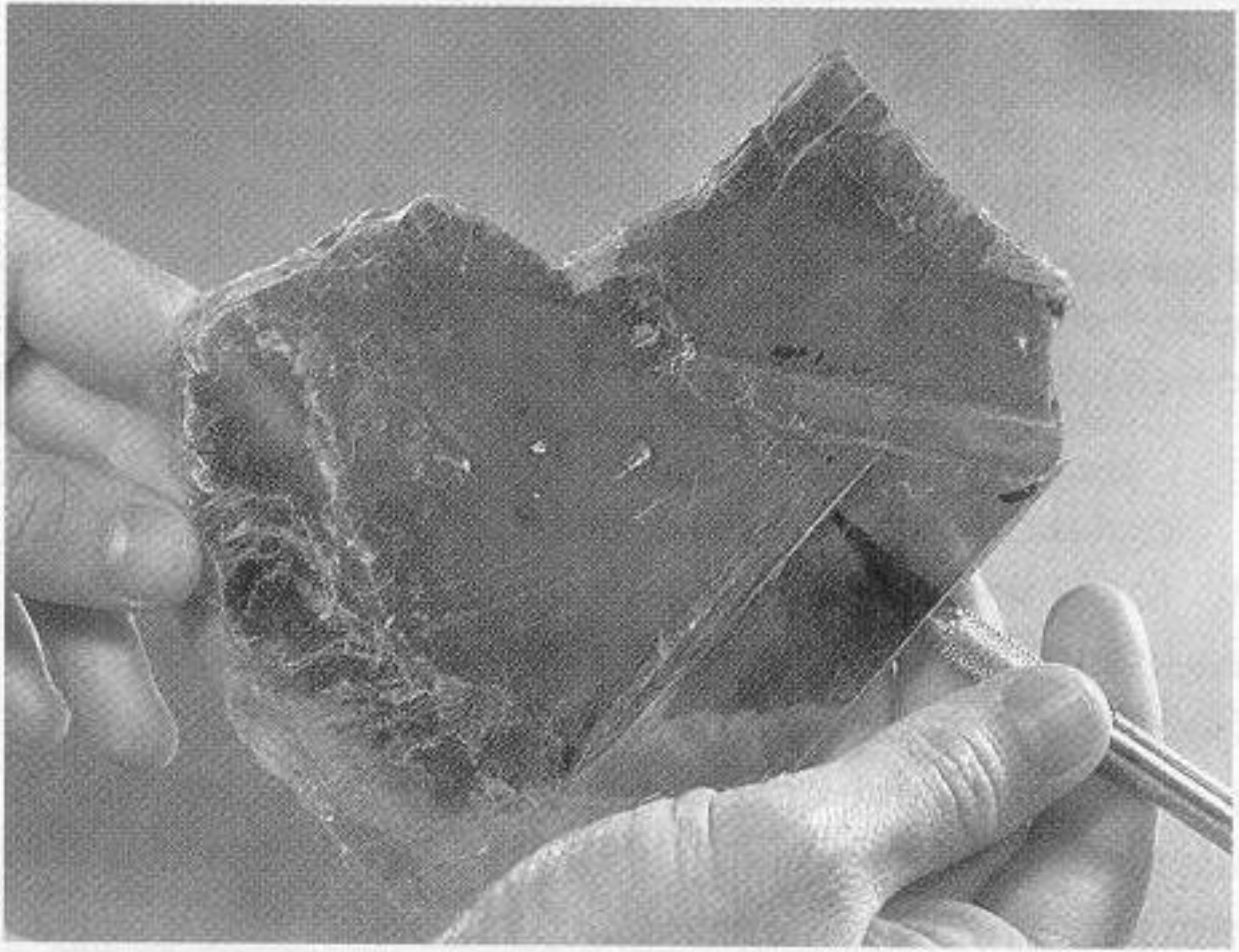


Figure 2.12 The thin sheets shown here were produced by splitting a mica (muscovite) crystal parallel to its perfect cleavage. (Photo by Breck P. Kent)

Table 2.2 Mohs Scale of Hardness

Relative Scale		Mineral	Hardness of Some Common Objects
Hardest	10	Diamond	
	9	Corundum	
	8	Topaz	
	7	Quartz	
	6	Potassium Feldspar	
	5	Apatite	5.5 Glass, Pocketknife
	4	Fluorite	
	3	Calcite	3 Copper Penny
	2	Gypsum	2.5 Fingernail
Softest	1	Talc	

Figure 2.14 Conchoidal fracture. The smooth curved surfaces result when minerals break in a glasslike manner. (Photo by E. J. Tarbuck)

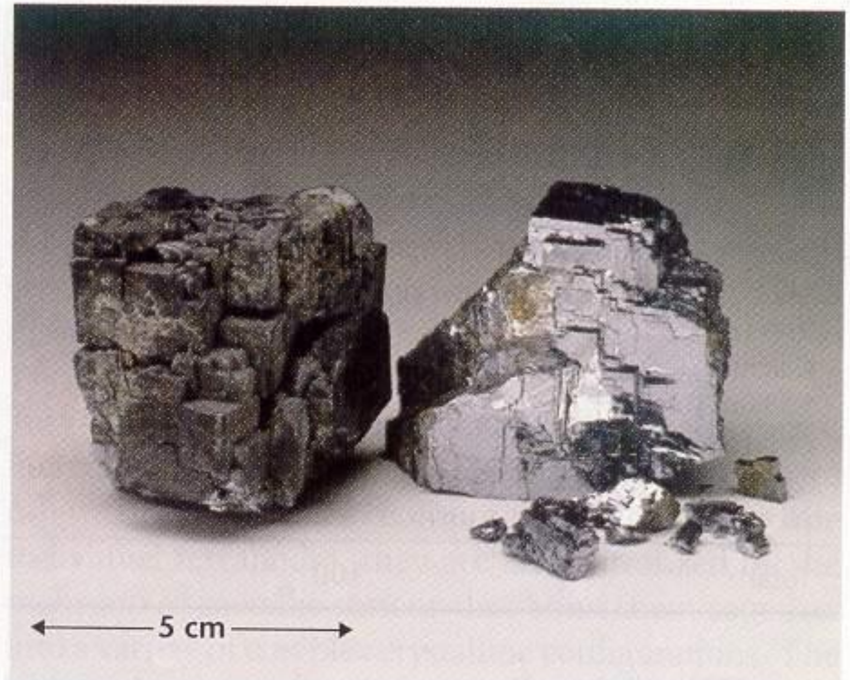


Figure 2.15 Galena is lead sulfide and, like other metallic ores, has a relatively high specific gravity.

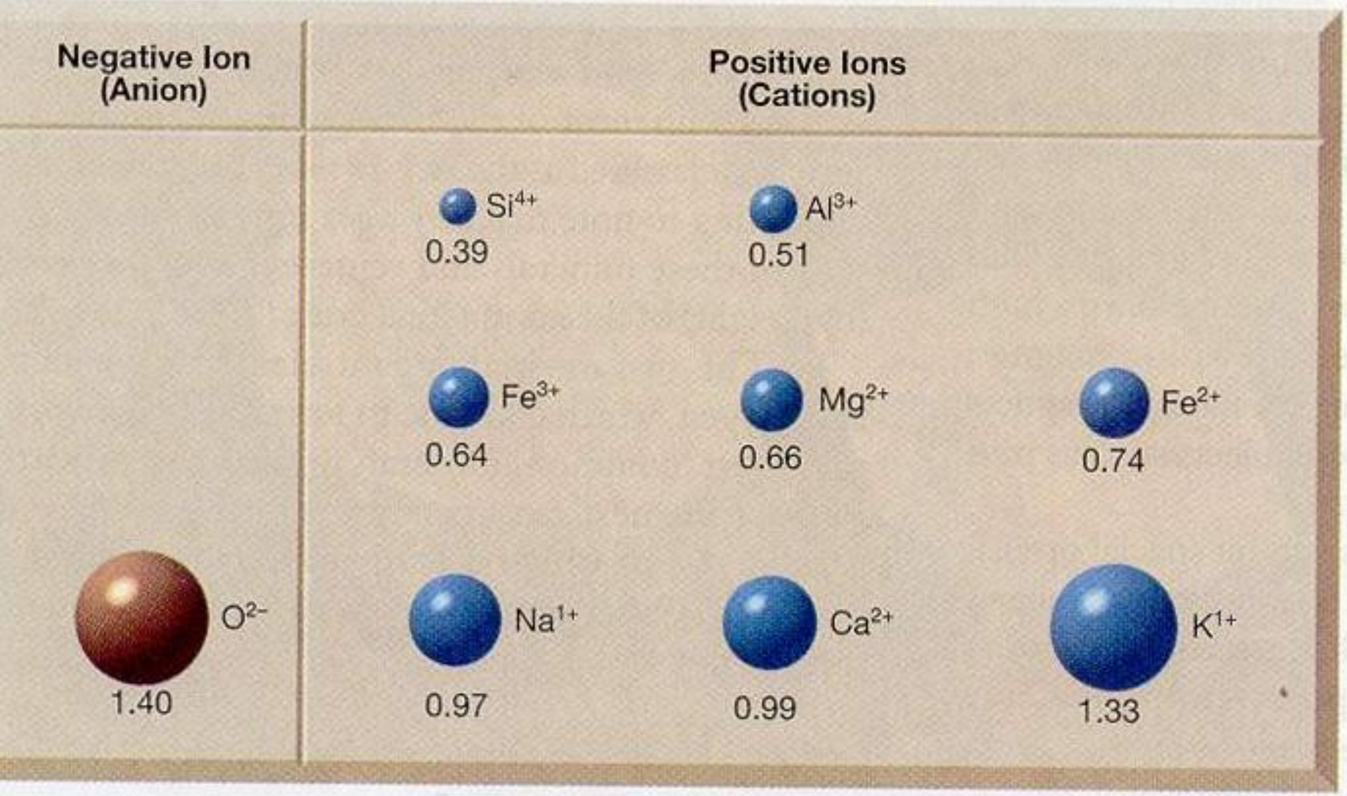


Figure 2.17 Relative sizes and electrical charges of ions of the eight most common elements in Earth's crust. These are the most common ions in rock-forming minerals. Ionic radii are expressed in angstroms (1 angstrom equals 10^{-8} cm).

Mineral Grupları

- *Silikatlar
  - -Ferromagnezyen (koyu renkli) silikatlar
  - -Ferromagnezyen olmayan (açık renkli) silikatlar
- *Silikat olmayan mineraller

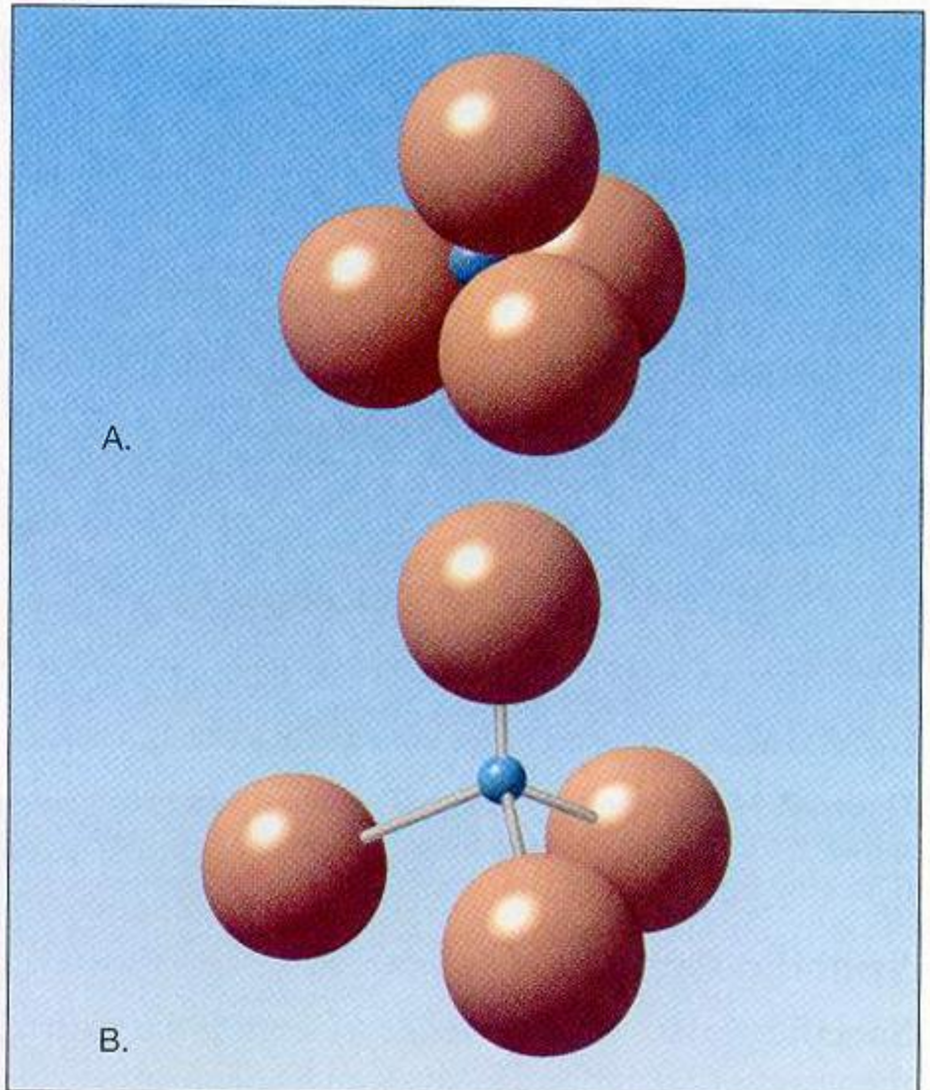


Figure 2.16 Two representations of the silicon–oxygen tetrahedron. **A.** The four large spheres represent oxygen ions, and the blue sphere represents a silicon ion. The spheres are drawn in proportion to the radii of the ions. **B.** An expanded view of the tetrahedron using rods to depict the bonds that connect the ions.

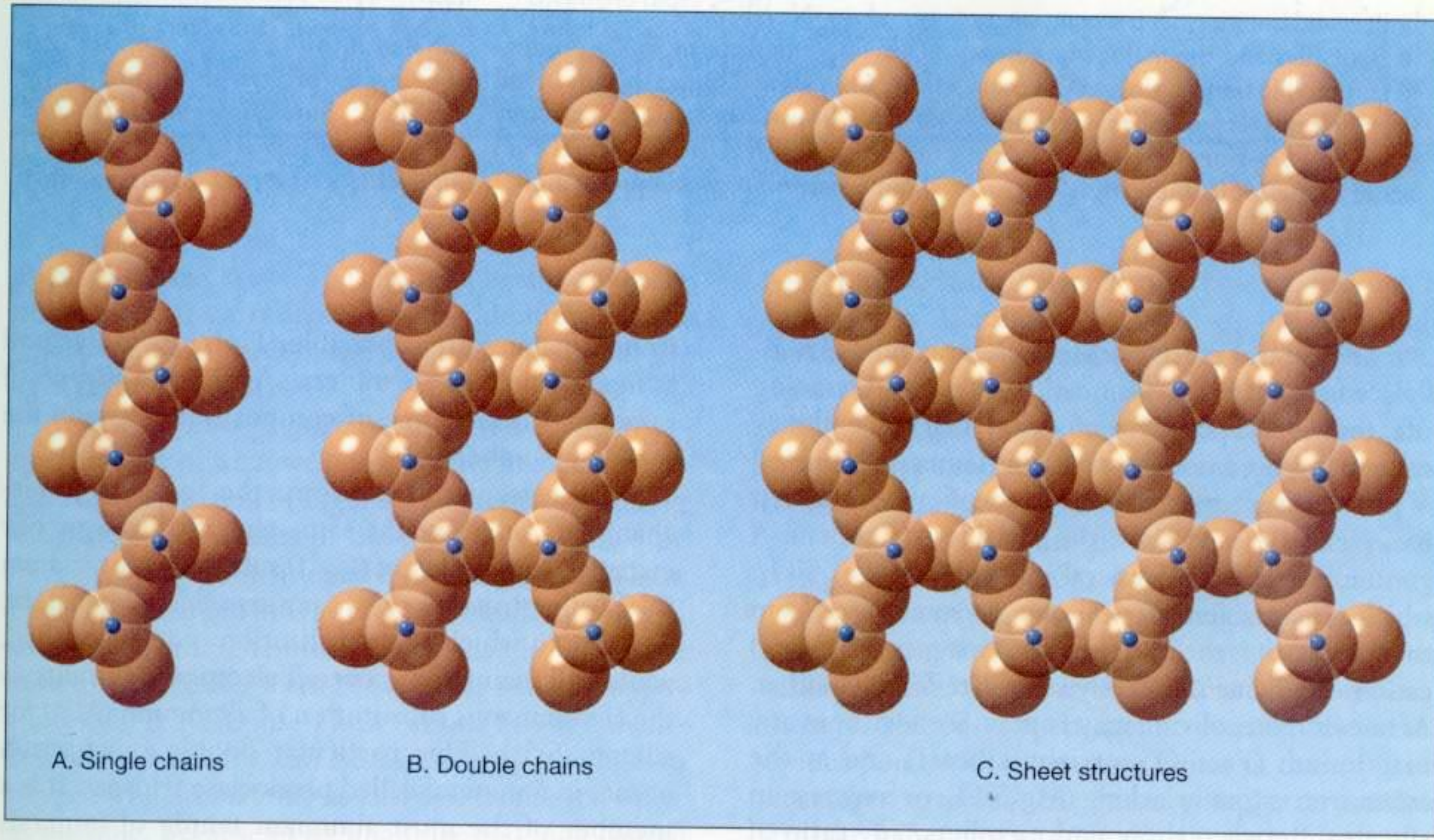


Figure 2.18 Three types of silicate structures. **A.** Single chains. **B.** Double chains. **C.** Sheet structures.

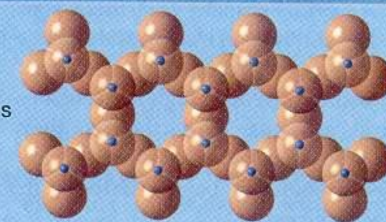
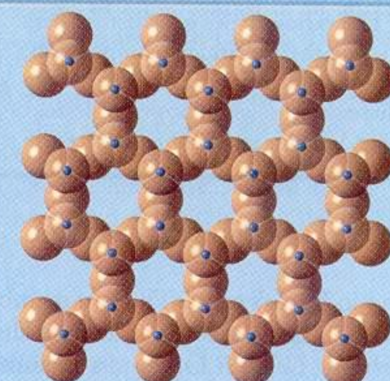
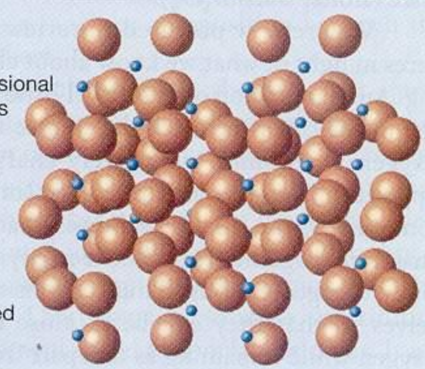
Mineral		Idealized Formula	Cleavage	Silicate Structure
Olivine		$(Mg, Fe)_2SiO_4$	None	Single tetrahedron 
Pyroxene group (Augite)		$(Mg,Fe)SiO_3$	Two planes at right angles	Single chains 
Amphibole group (Hornblende)		$Ca_2(Fe,Mg)_5Si_8O_{22}(OH)_2$	Two planes at 60° and 120°	Double chains 
Micas	Biotite	$K(Mg,Fe)_3AlSi_3O_{10}(OH)_2$	One plane	Sheets 
	Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$		
Feld-spars	Orthoclase	$KAlSi_3O_8$	Two planes at 90°	Three-dimensional networks (Expanded view) 
	Plagioclase	$(Ca,Na)AlSi_3O_8$		
Quartz		SiO_2	None	

Figure 2.19 Common silicate minerals. Note that the complexity of the silicate structure increases down the chart.

Figure 2.20 Hornblende amphibole. Hornblende is a common dark silicate material having two cleavage directions that intersect at roughly 60° and 120°.

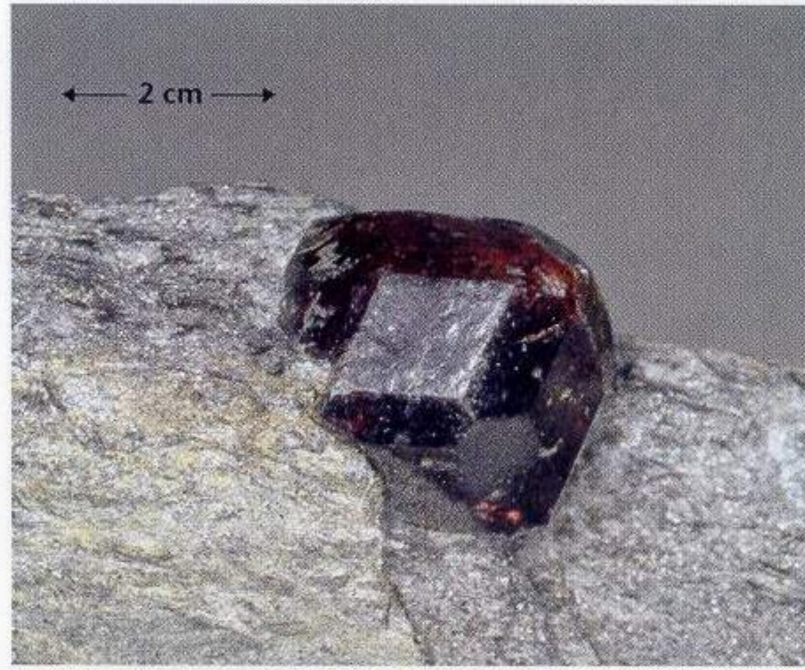


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Figure 2.24 These parallel lines, called striations, are a distinguishing characteristic of the plagioclase feldspars. (Photo by E. J. Tarbuck)

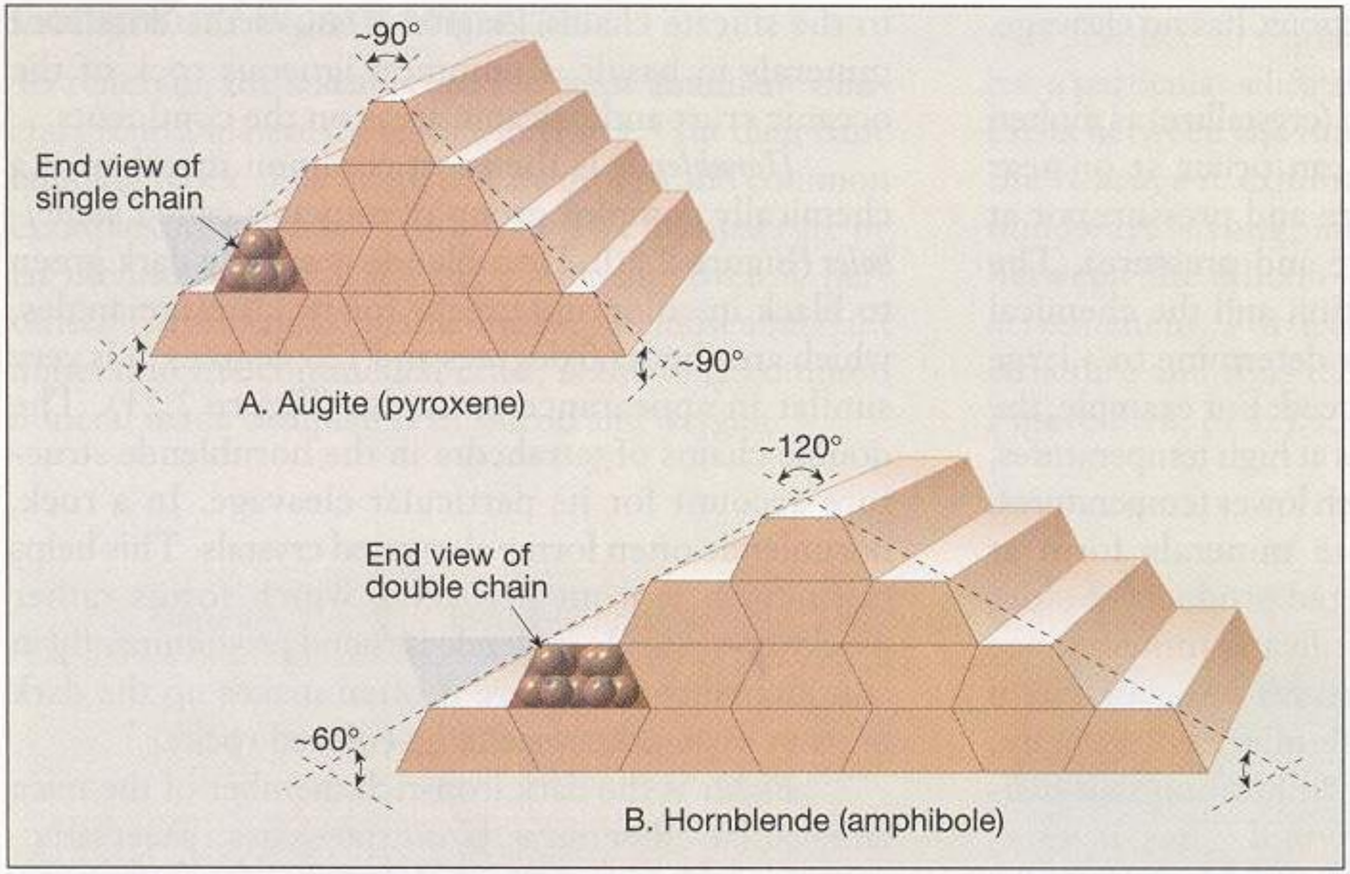

Figure 2.21 Cleavage angles for augite and hornblende.

Table 2.4 Common Nonsilicate Mineral Groups

Group	Member	Formula	Economic Use
Oxides	Hematite	Fe_2O_3	Ore of iron, pigment
	Magnetite	Fe_3O_4	Ore of iron
	Corundum	Al_2O_3	Gemstone, abrasive
	Ice	H_2O	Solid form of water
	Chromite	$FeCr_2O_4$	Ore of chromium
	Ilmenite	$FeTiO_3$	Ore of titanium
Sulfides	Galena	PbS	Ore of lead
	Sphalerite	ZnS	Ore of zinc
	Pyrite	FeS_2	Sulfuric acid production
	Chalcopyrite	$CuFeS_2$	Ore of copper
	Bornite	Cu_5FeS_2	Ore of copper
	Cinnabar	HgS	Ore of mercury
Sulfates	Gypsum	$CaSO_4 \cdot 2H_2O$	Plaster
	Anhydrite	$CaSo_4$	Plaster
	Barite	$BaSO_4$	Drilling mud
Native elements	Gold	Au	Trade, jewelry
	Copper	Cu	Electrical conductor
	Diamond	C	Gemstone, abrasive
	Sulfur	S	Sulfa drugs, chemicals
	Graphite	C	Pencil lead, dry lubricant
	Silver	Ag	Jewelry, photography
	Platinum	Pt	Catalyst
Halides	Halite	$NaCl$	Common salt
	Fluorite	CaF_2	Used in steelmaking
	Sylvite	KCl	Fertilizer
Carbonates	Calcite	$CaCO_3$	Portland cement, lime
	Dolomite	$CaMg(CO_3)_2$	Portland cement, lime
	Malachite	$Cu_2(OH)_2CO_3$	Gemstone
	Azurite	$Cu_3(OH)_2(CO_3)_2$	Gemstone
Hydroxides	Limonite	$FeO(OH) \cdot nH_2O$	Ore of iron, pigments
	Bauxite	$Al(OH)_3 \cdot nH_2O$	Ore of aluminum
Phosphates	Apatite	$Ca_5(F,Cl,OH)(PO_4)_3$	Fertilizer
	Turquoise	$CuAl_6(PO_4)_4(OH)_8$	Gemstone

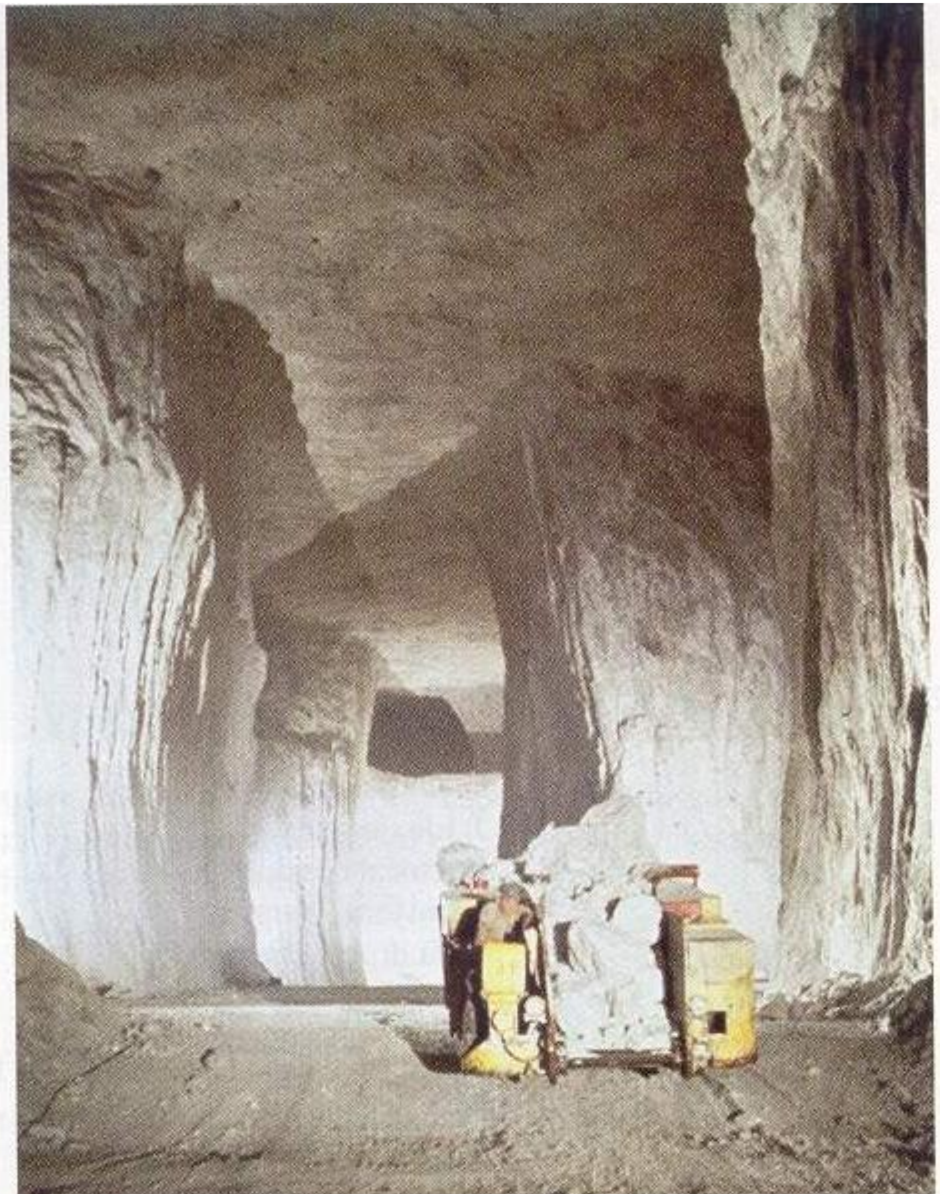

Figure 2.26 Thick beds of halite (salt) at an underground mine near Grand Saline, Texas. (Photo by D. A. Humphreys)