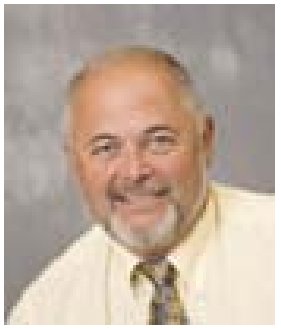
EAPS 10000 Y01
Online Course
Planet Earth

Prof. Lawrence Braile

Welcome to the EAPS 10000 Y01 online course
Planet Earth *(also known as EAPS 100)!*



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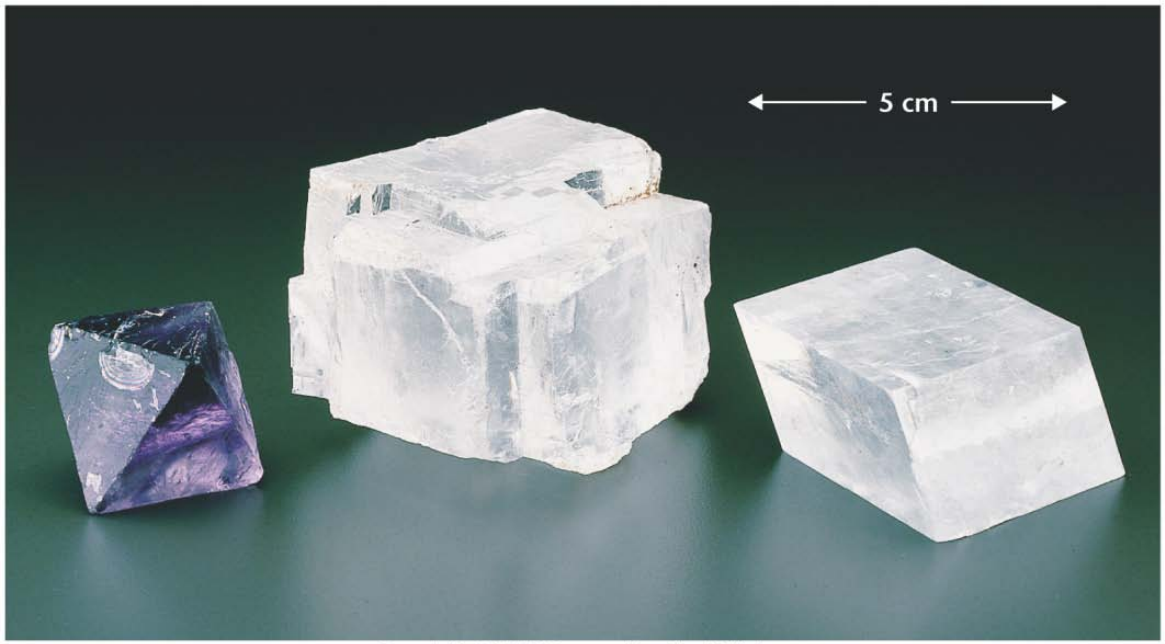
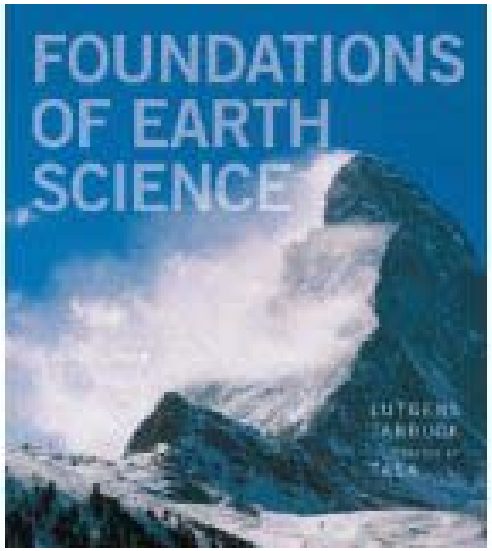
Earth Atmospheric Planetary Sciences

EAPS 10000 Y01 – Planet Earth (online course)
Week 1, Chapter 1 (pages 22-43, text)

Week	Chapter	Assigned Pages	Major Concepts	Important Terms
1	**1 – Minerals**	22 – 43	Physical properties of minerals, mineral resources, chemical composition	Mineral, rock, bonds, isotopes, silicate, silicon-oxygen tetrahedron





EAS 10000 Y01 – Planet Earth (online course)
Week 1, Chapter 1 (pages 22-43, text)

When you have finished reading Chapter 1 and viewing the PowerPoint file for Week.1.Chapter.1, take the chapter quiz (Qz 1; be sure to read the Syllabus for more information on quizzes). You can use your book, notes, etc. during the quiz.

The PPT files (converted to PDF files) are best viewed with the Full Screen view in browsers.

The following slides illustrate some of the important concepts and topics of Chapter 1.

Earth Materials:

Mineral: Naturally occurring, inorganic solid, distinct chemical composition, regular crystal structure, characteristic physical properties. Examples: quartz, calcite, mica, feldspar, olivine, diamond, pyrite (iron sulfide), garnet, gold, hematite, galena (lead sulfide), talc, gypsum, beryl (includes emeralds), halite (salt, NaCl), corundum (includes sapphire), and topaz (many of these minerals may be familiar to you because they sometimes are gems).

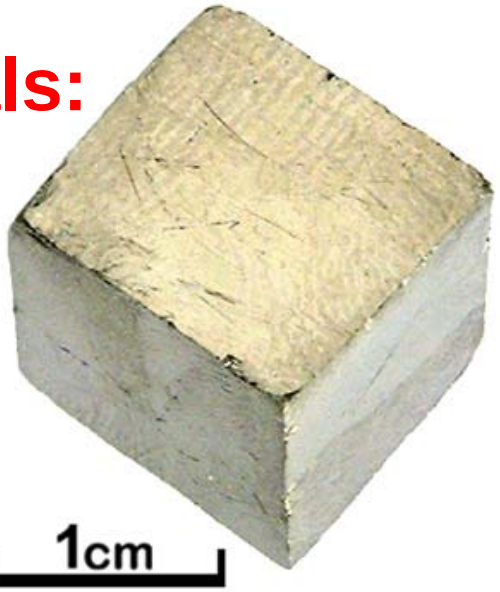
Rock (will be studied in Chapter 2):
Aggregate of minerals.

Igneous, sedimentary, metamorphic.

Giant gypsum (mineral) crystals from the Cave of Crystals, Chihuahua, Mexico (Figure, page 22, Text)

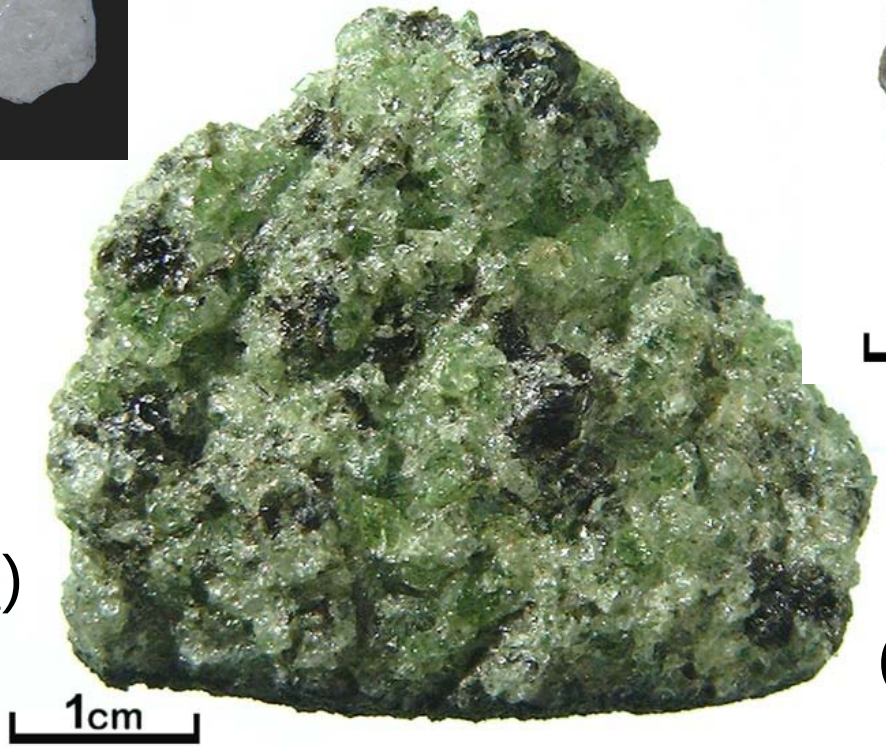
Examples of Minerals:

Quartz (SiO_2)



Pyrite (FeS_2)

Hematite (Fe_2O_3)



Olivine ($[Mg,Fe]_2SiO_4$)

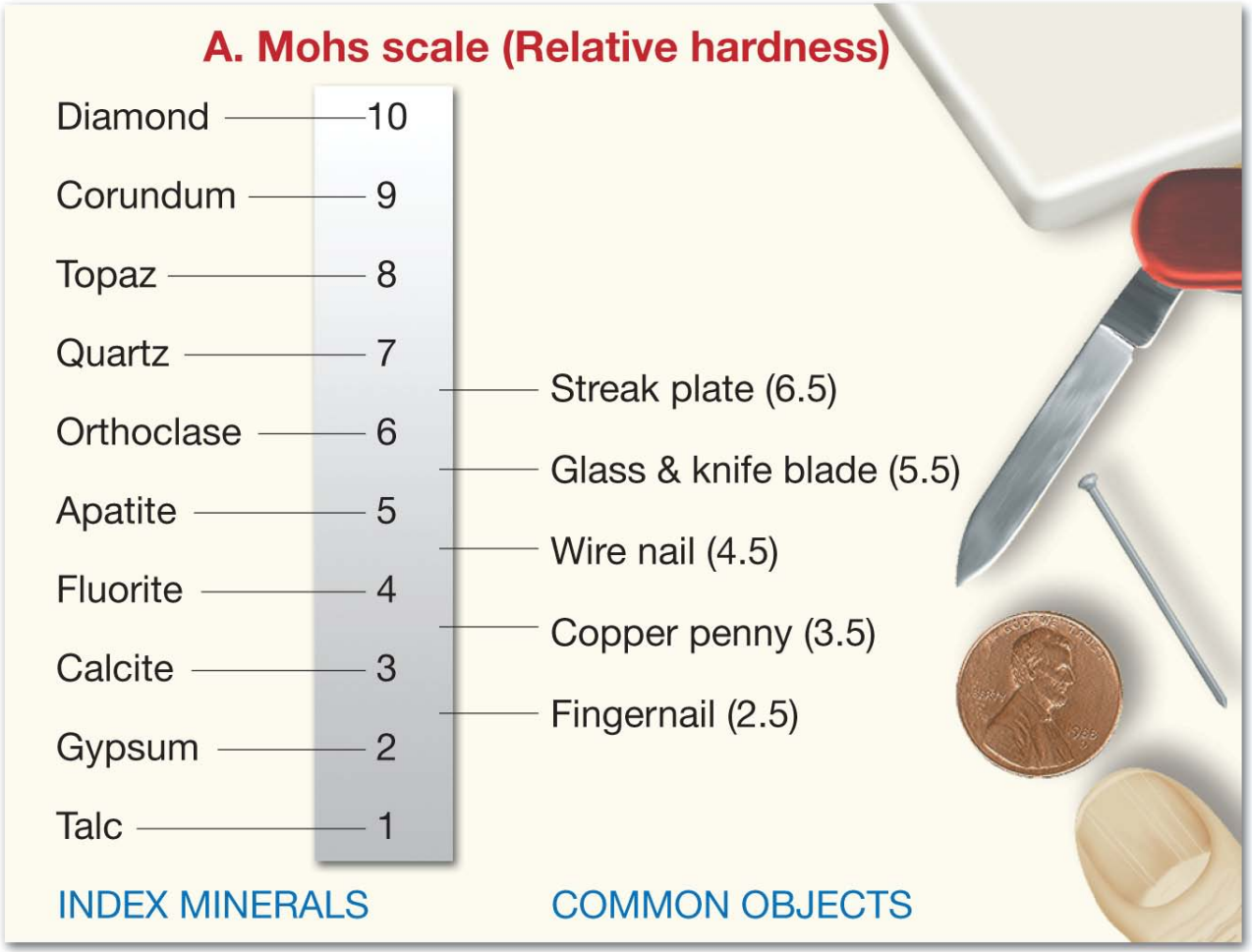
(Text, 5th edition)

Olivine – an important silicate mineral (iron/magnesium silicate) in the Earth's mantle (the mantle is 82% of the planet by volume).

Mineral (characteristic physical properties – an important concept for minerals):

Characteristic physical properties – hardness, crystal structure, cleavage, color streak, density

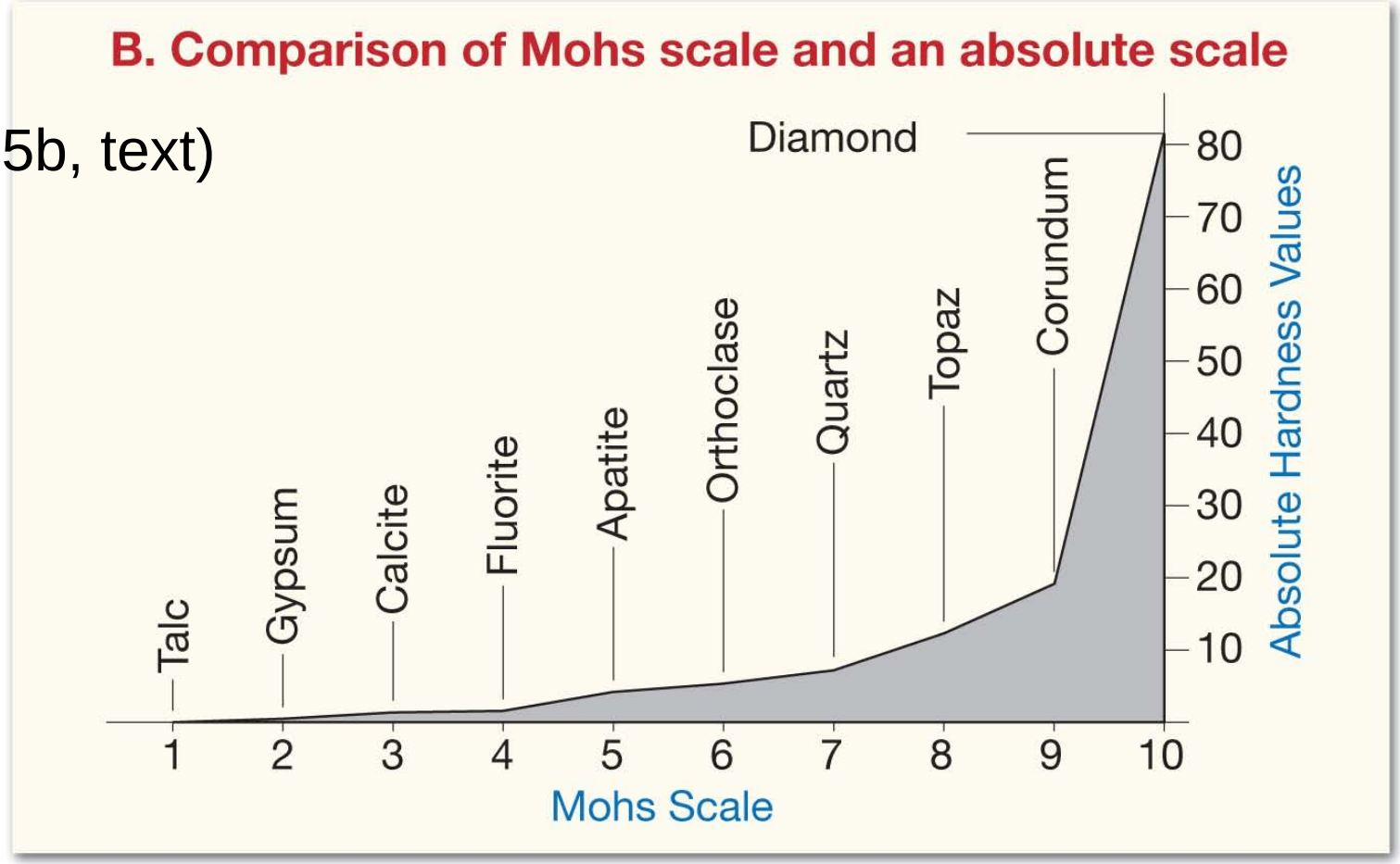
(Figure 1.15a, text)



Mineral (characteristic physical properties – an important concept for minerals):

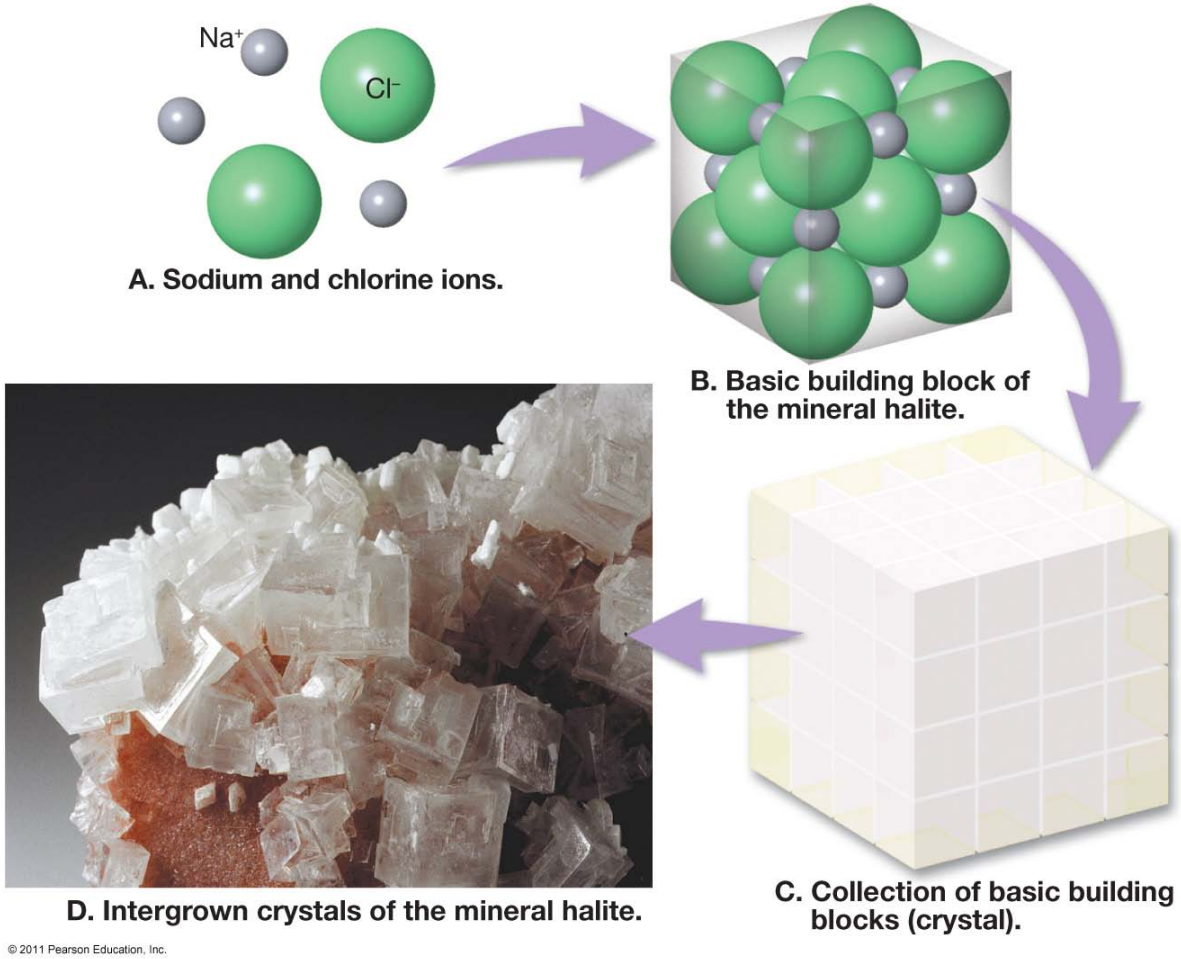
Characteristic physical properties – The hardness scale

(Figure 1.15b, text)



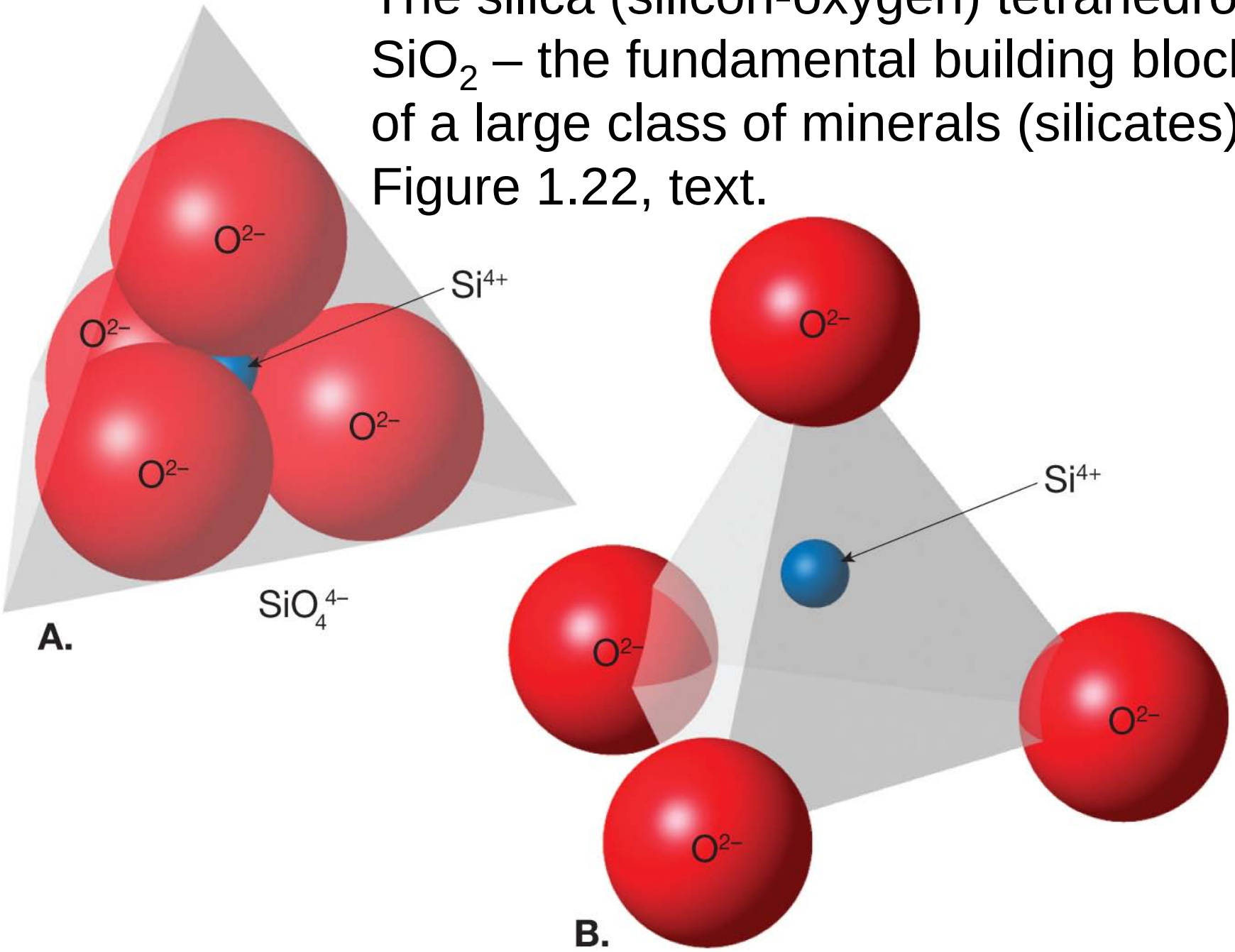
Mineral (characteristic physical properties – an important concept for minerals):

Characteristic physical properties – crystal structure



Mineral properties: Regular crystal structure (atomic scale) results in characteristic crystal shape and cleavage (Figure 1.2, text).

The silica (silicon-oxygen) tetrahedron, SiO_2 – the fundamental building block of a large class of minerals (silicates), Figure 1.22, text.



Most rocks (including most of the Earth's crust and mantle – *over 82% of the volume of the Earth*) are ***silicates*** with a chemical formula similar to:

$XSiO_2$ ← not always 2

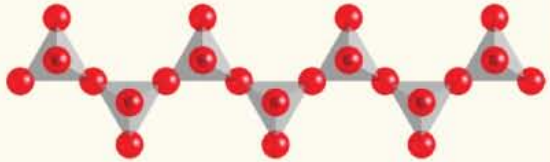
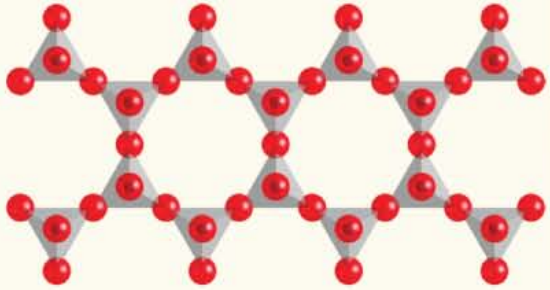
where 'X' is K, Na, Al, Fe, Mg, Ca, or a combination of elements.

Another common rock type in the sedimentary layer is *Limestone (consists primarily of the mineral calcite):*

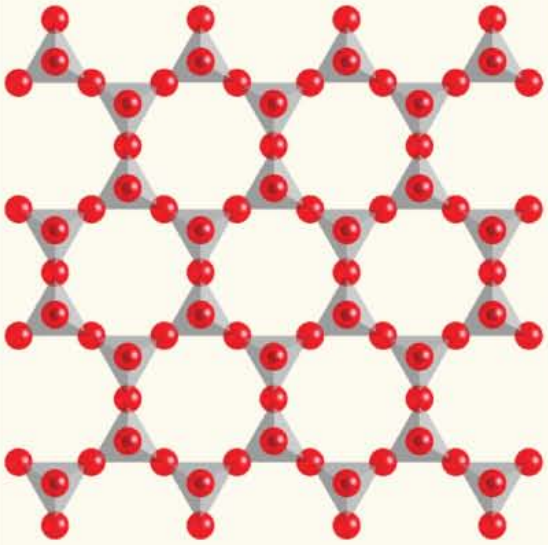
$CaCO_3$

Note the rhombohedral cleavage planes of the mineral Calcite

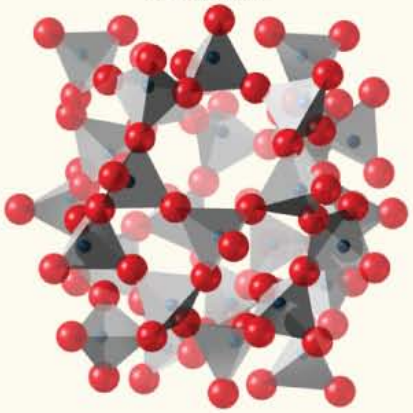
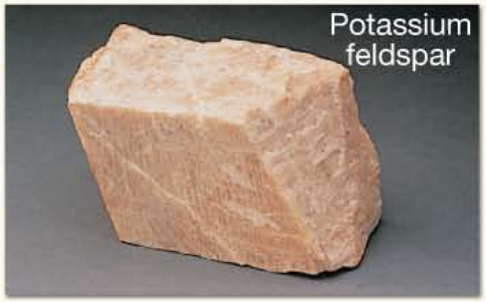
Examples of Silicate Mineral Groups (different structures and examples of minerals in each group):

Mineral/Formula	Cleavage	Silicate Structure	Example
Olivine group $(Mg, Fe)_2SiO_4$	None	Single tetrahedron 	 Olivine
Pyroxene group (Augite) $(Mg,Fe)SiO_3$	Two planes at 90°	Single chains 	 Augite
Amphibole group (Hornblende) $Ca_2(Fe,Mg)_5Si_8O_{22}(OH)_2$	Two planes at 60° and 120°	Double chains 	 Hornblende

Silicate minerals,
(Figure 1.23, text)

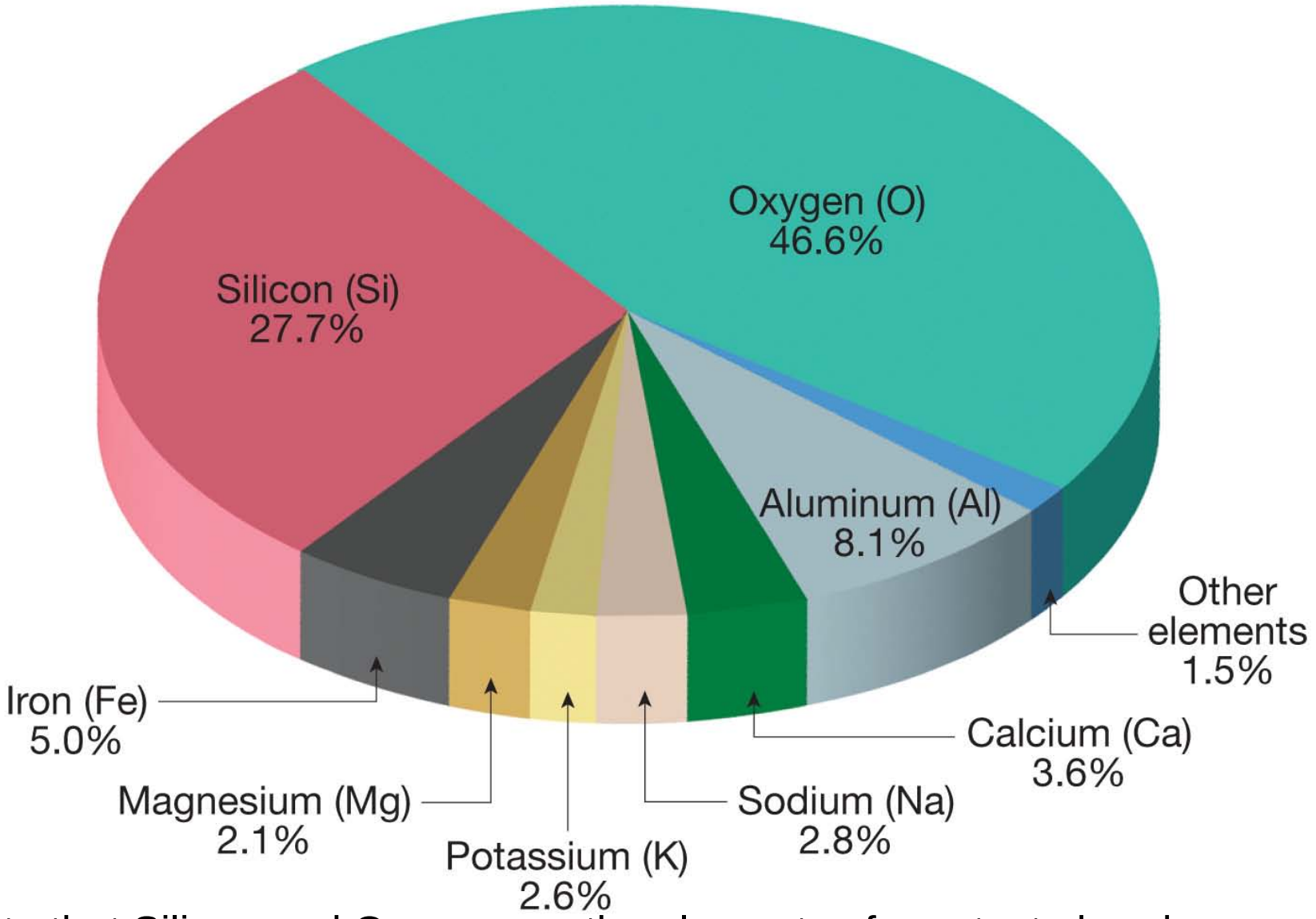
Mineral/Formula	Cleavage	Silicate Structure	Example
Micas: **Biotite** $K(Mg,Fe)_3AlSi_3O_{10}(OH)_2$	One plane	Sheets 	
Micas: **Muscovite** $KAl_2(AlSi_3O_{10})(OH)_2$			

Silicate minerals,
(Figure 1.23, text)

Mineral/Formula		Cleavage	Silicate Structure	Example
Feldspars	Potassium feldspar (Orthoclase) $KAlSi_3O_8$	Two planes at 90°	Three-dimensional networks 	
	Plagioclase $(Ca,Na)AlSi_3O_8$			
	Quartz SiO_2	None		

Silicate minerals,
(Figure 1.23, text)

Relative abundance of the eight most common elements in the Earth's continental crust (Figure 1.21, text)



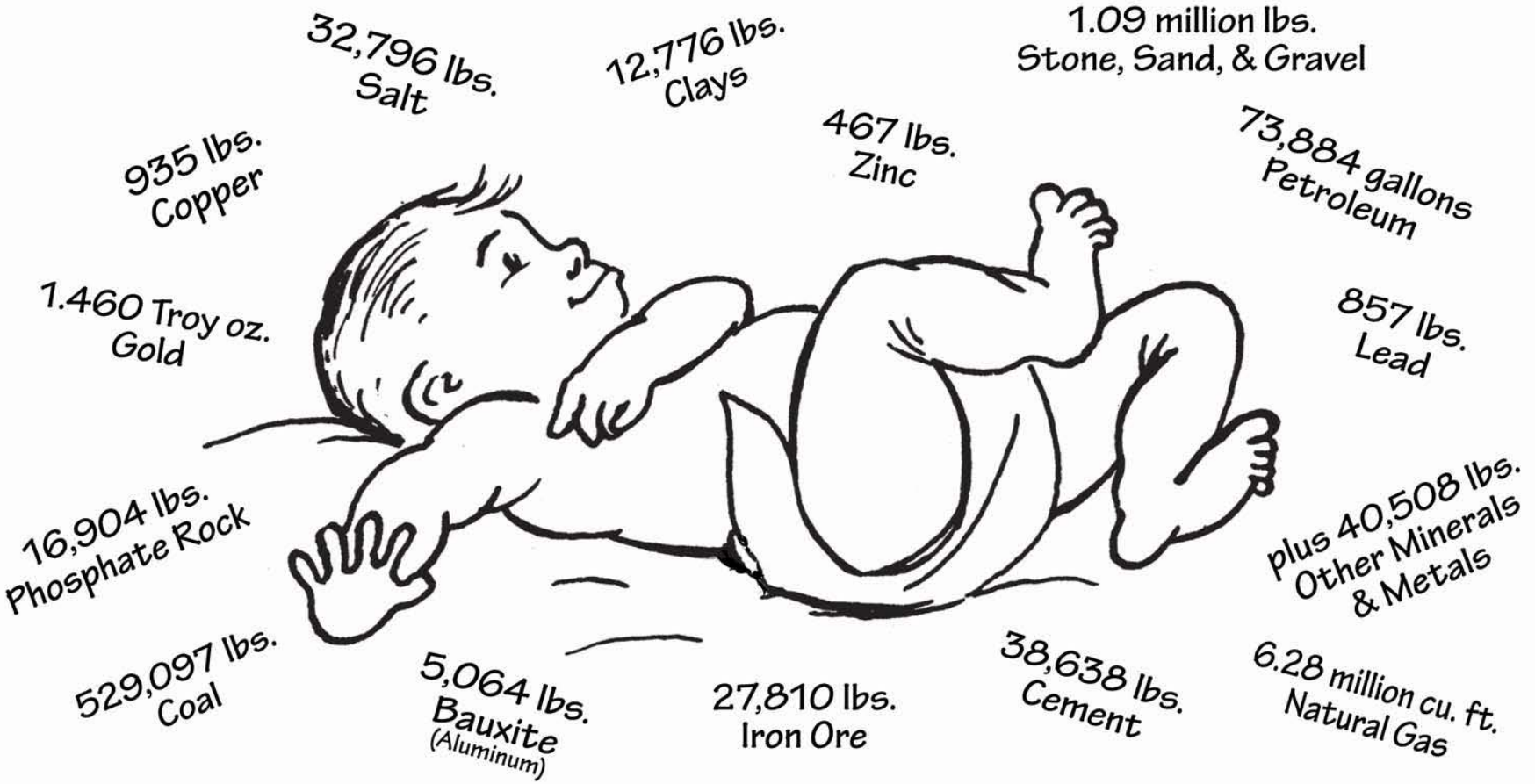
Note that Silicon and Oxygen are the elements of greatest abundance so it follows that silicate minerals are very abundant in the Earth's crust.

Many nonsilicate minerals have significant economic uses (Table 1.1, text)

Table 1.1 Common Nonsilicate Mineral Groups

Mineral Group	Name	Chemical 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
Sulfides	Galena	PbS	Ore of lead
	Sphalerite	ZnS	Ore of zinc
	Pyrite	FeS_2	Sulfuric acid production
	Chalcopyrite	$CuFeS_2$	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

Every American Born Will Need...



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