Unit 2

Rocks

What is a rock?

"minerals are to rocks as words are to sentences."

-Some rocks are monomineralic (1 mineral)

-most rocks are polymineralic (2 or more minerals)

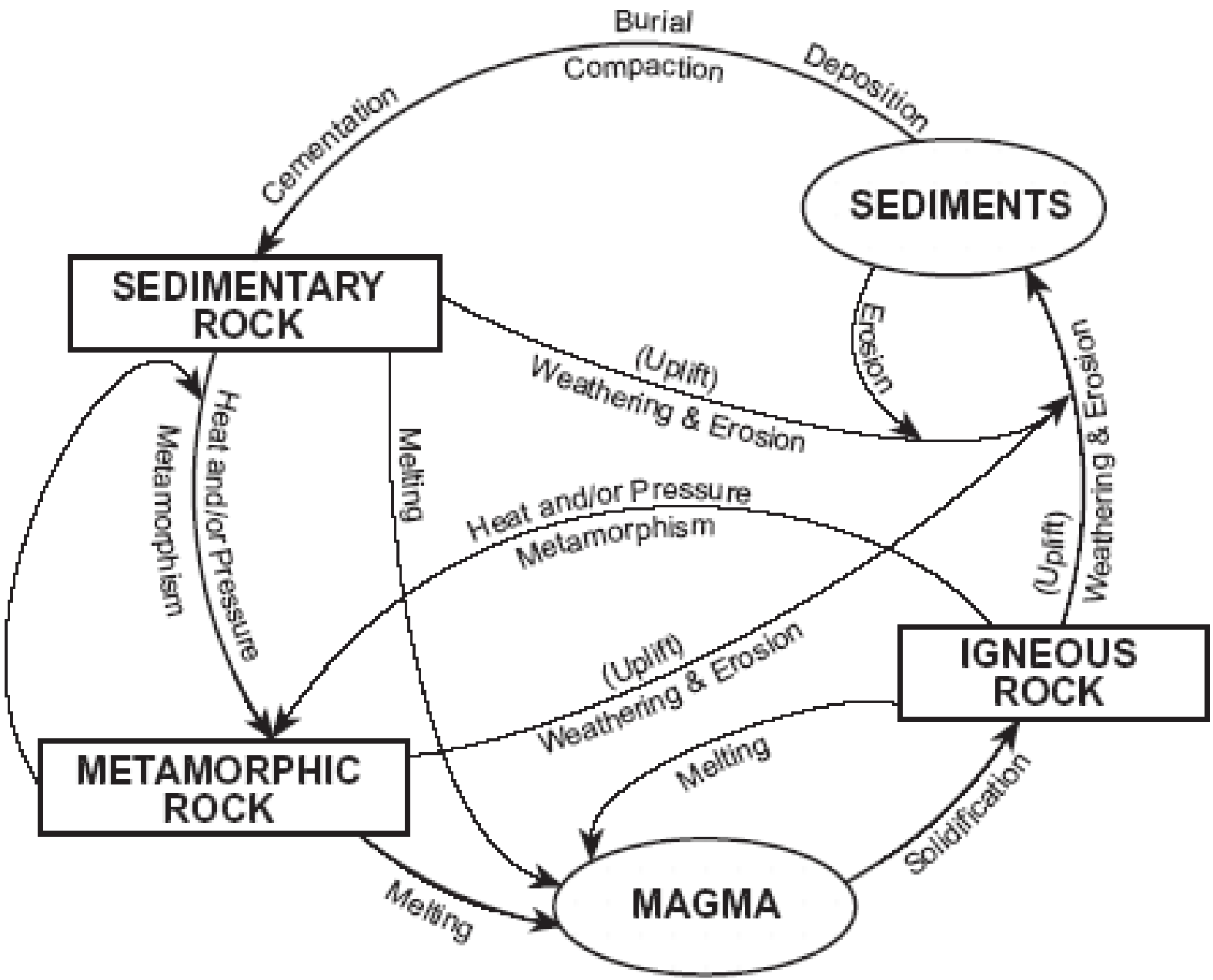
What are the three types of rocks?

1) Igneous
   -made from volcanoes

2) Sedimentary
   -made from pieces (sediments) of other rocks

3) Metamorphic
   -form when a rock experience intense heat and/or pressure

Rock Cycle in Earth's Crust



Igneous Rocks

-are formed from the solidification and crystallization of molten rock.

-usually contain many minerals

Under the earth's surface molten rock is called <u>magma</u>

When magma reaches the earth's surface it's called <u>lava</u>

Two types of igneous Rocks

1) Intrusive

   -cools underground from _____

   -large crystal sizes

   -takes longer to cool so crystals have more time to grow

Two types of igneous Rocks

1) Extrusive

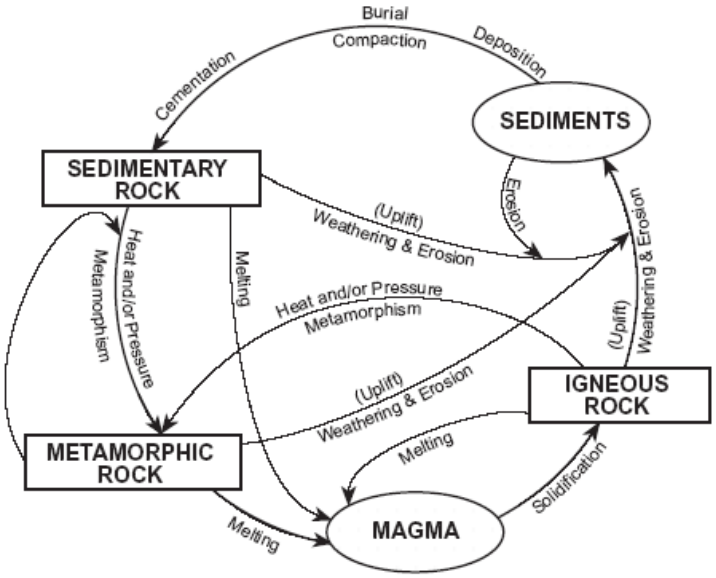
-cools above ground from _____

-tiny crystal sizes or no crystals (glass)

-cools fast so crystals have little or no time to grow

-may be vesicular (gas pockets)

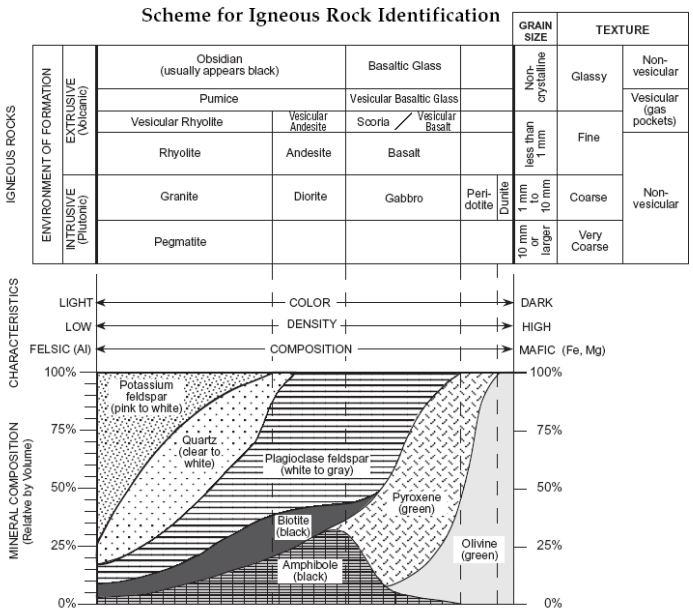
Rock Cycle in Earth's Crust



Scheme for Sedimentary Rock Identification

INORGANIC LAND-DERIVED SEDIMENTARY ROCKS					
TEXTURE	GRAIN SIZE	COMPOSITION	COMMENTS	ROCK NAME	MAP SYMBOL
Clastic (fragmental)	Pebbles, cobbles, and/or boulders embedded in sand, silt, and/or clay	Mostly quartz, feldspar, and clay minerals; may contain fragments of other rocks and minerals	Rounded fragments	Conglomerate	
			Angular fragments	Breccia	
	Sand (0.006 to 0.2 cm)		Fine to coarse	Sandstone	
	Silt (0.0004 to 0.006 cm)		Very fine grain	Siltstone	
	Clay (less than 0.0004 cm)		Compact; may split easily	Shale	
CHEMICALLY AND/OR ORGANICALLY FORMED SEDIMENTARY ROCKS					
TEXTURE	GRAIN SIZE	COMPOSITION	COMMENTS	ROCK NAME	MAP SYMBOL
Crystalline	Fine to coarse crystals	Halite	Crystals from chemical precipitates and evaporites	Rock salt	
		Gypsum		Rock gypsum	
		Dolomite		Dolostone	
Crystalline or bioclastic	Microscopic to very coarse	Calcite	Precipitates of biologic origin or cemented shell fragments	Limestone	
Bioclastic		Carbon	Compacted plant remains	Bituminous coal	

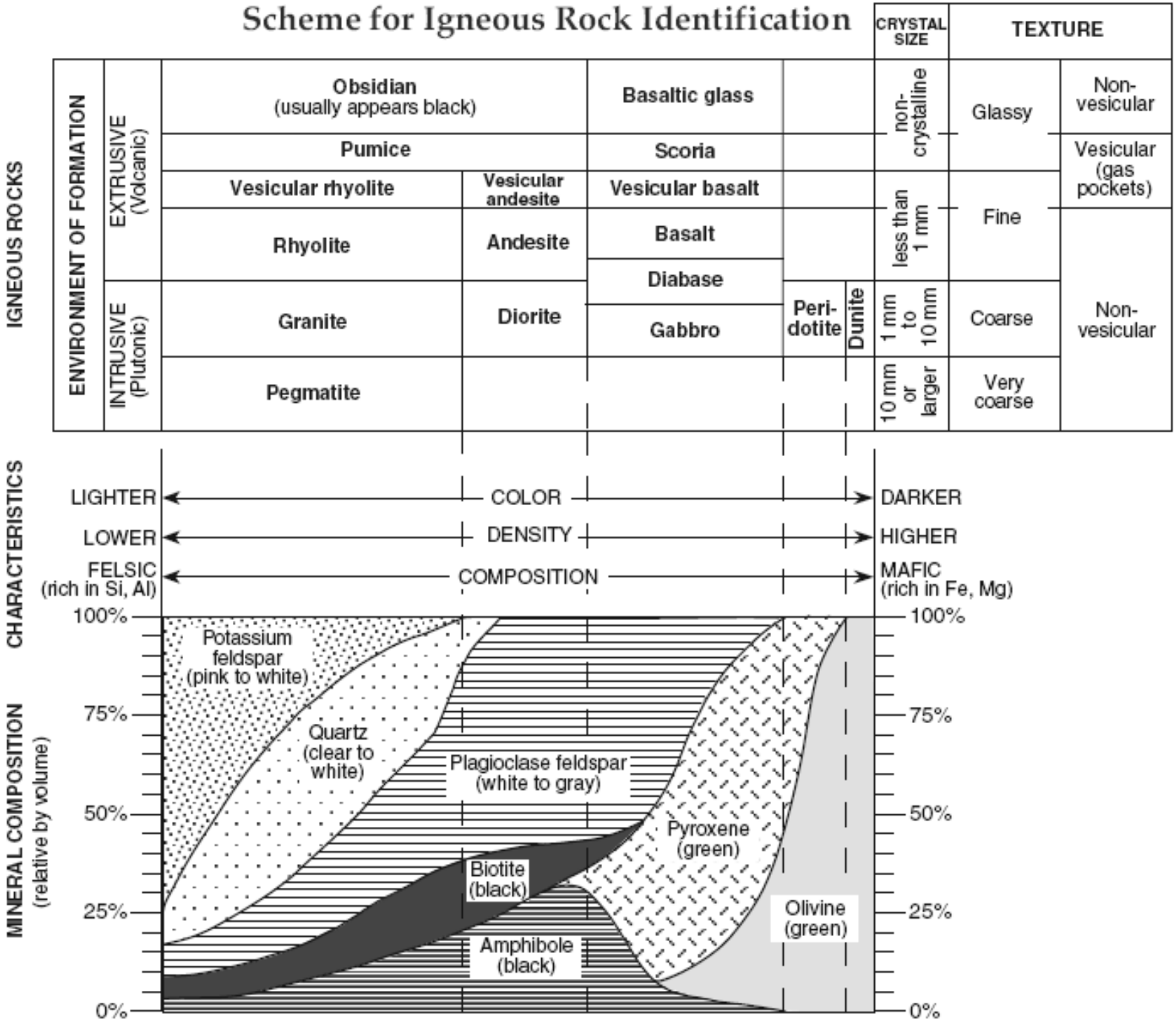
Scheme for Igneous Rock Identification



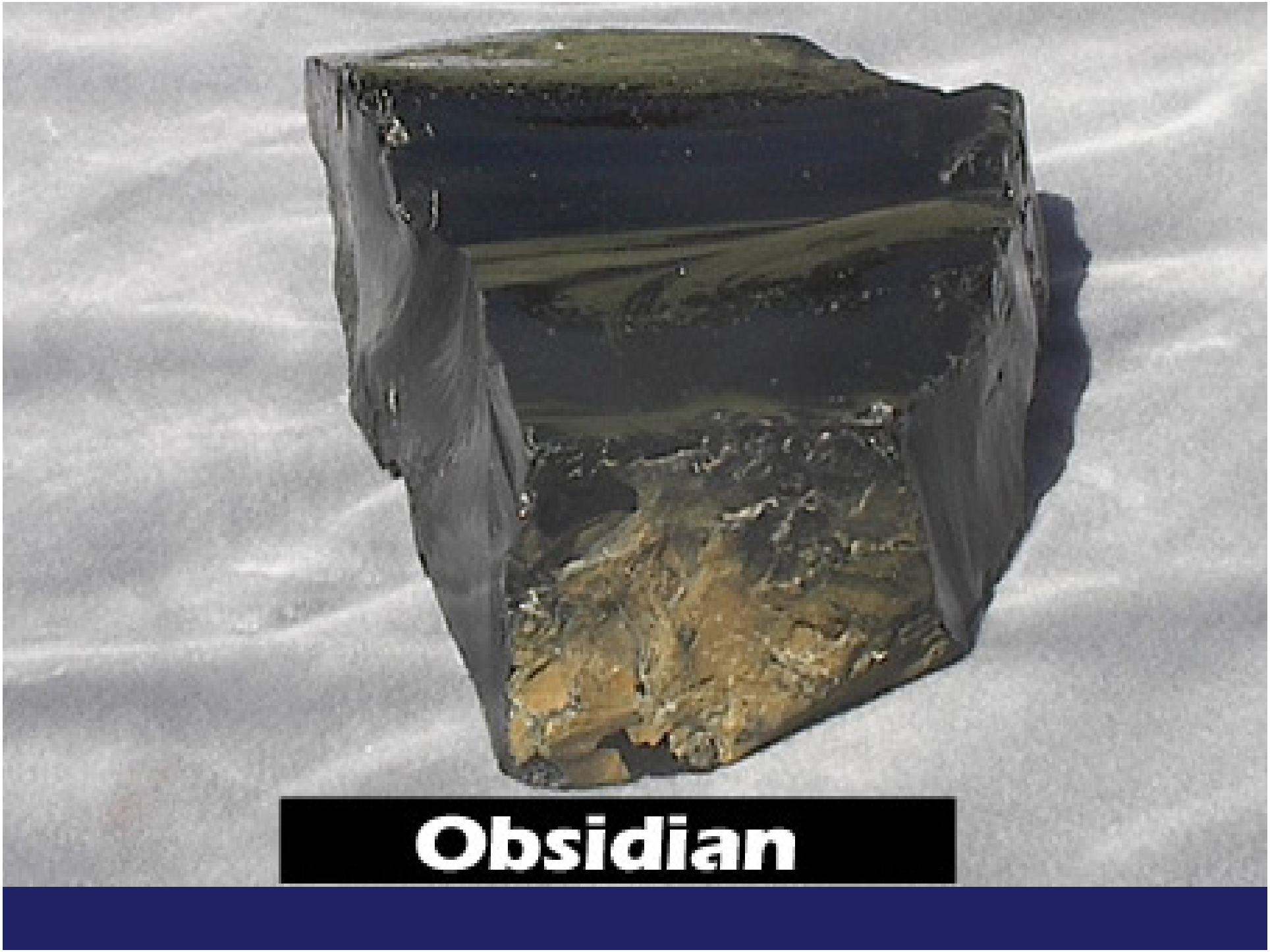
Scheme for Metamorphic Rock Identification

TEXTURE		GRAIN SIZE	COMPOSITION	TYPE OF METAMORPHISM	COMMENTS	ROCK NAME	MAP SYMBOL
FOLIATED	MINERAL ALIGNMENT	Fine	MICA, QUARTZ, FELDSPAR, AMPHIBOLE, GARNET, PYROXENE	Regional (Heat and pressure increases)	Low-grade metamorphism of shale	Slate	
		Fine to medium			Foliation surfaces shiny from microscopic mica crystals	Phyllite	
					Platy mica crystals visible from metamorphism of clay or feldspars	Schist	
	BAND-ING	Medium to coarse			High-grade metamorphism; mineral types segregated into bands	Gneiss	
NONFOLIATED		Fine	Carbon	Regional	Metamorphism of bituminous coal	Anthracite coal	
		Fine	Various minerals	Contact (heat)	Various rocks changed by heat from nearby magma/lava	Hornfels	
		Fine to coarse	Quartz	Regional or contact	Metamorphism of quartz sandstone	Quartzite	
			Calcite and/or dolomite		Metamorphism of limestone or dolostone	Marble	
		Coarse	Various minerals		Pebbles may be distorted or stretched	Metaconglomerate	

Scheme for Igneous Rock Identification



Extrusive Igneous rocks (from lava)


Obsidian

Obsidian

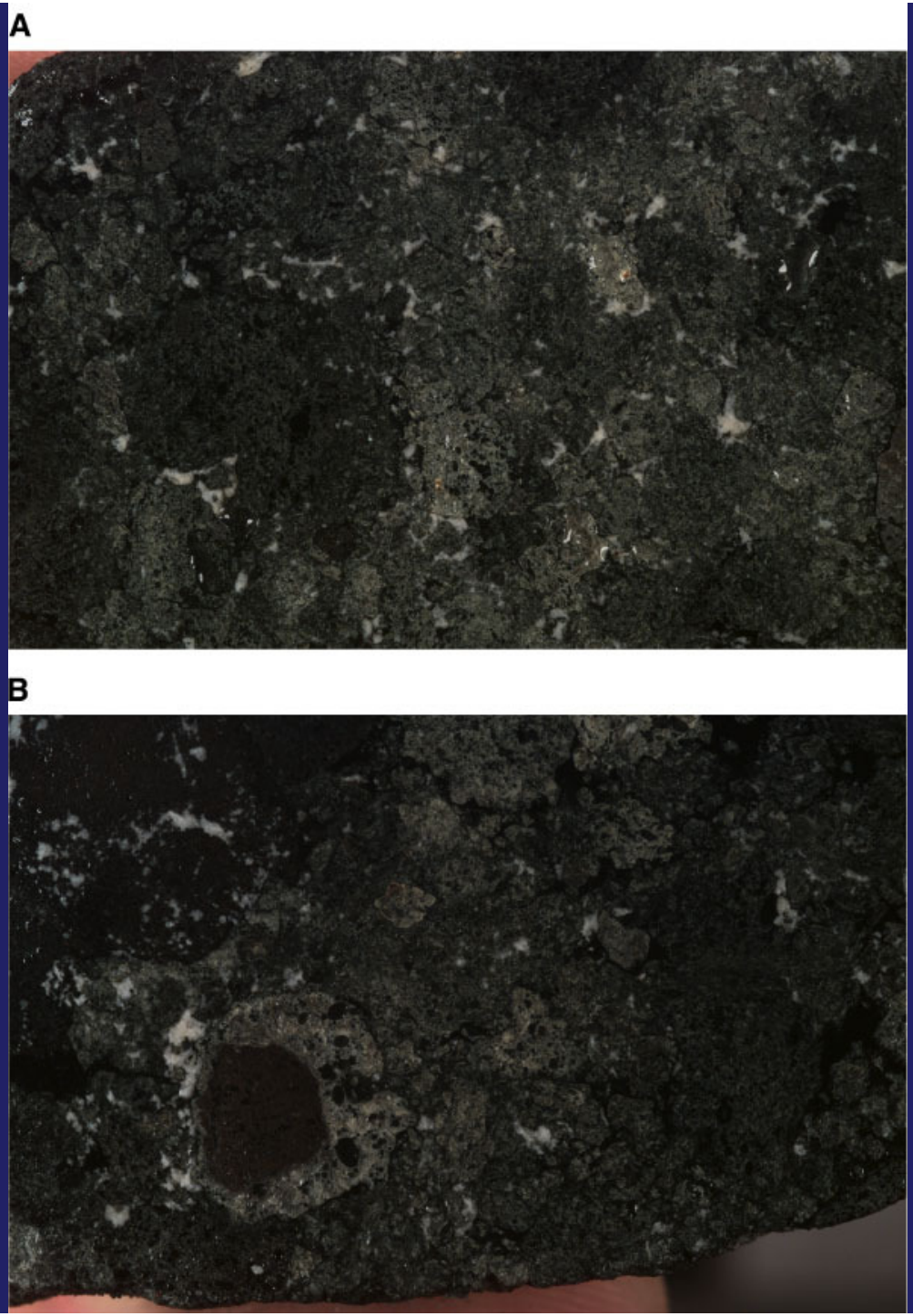
obsidian

The Palisades and the New York City skyline from Westchester County, NY. The George Washington Bridge crosses the Hudson River in the distance. These cliffs are the 60 km long edge of a Triassic intrusion of basaltic magma with prominent verical (columnar) joints.

TMcG, Nov 04

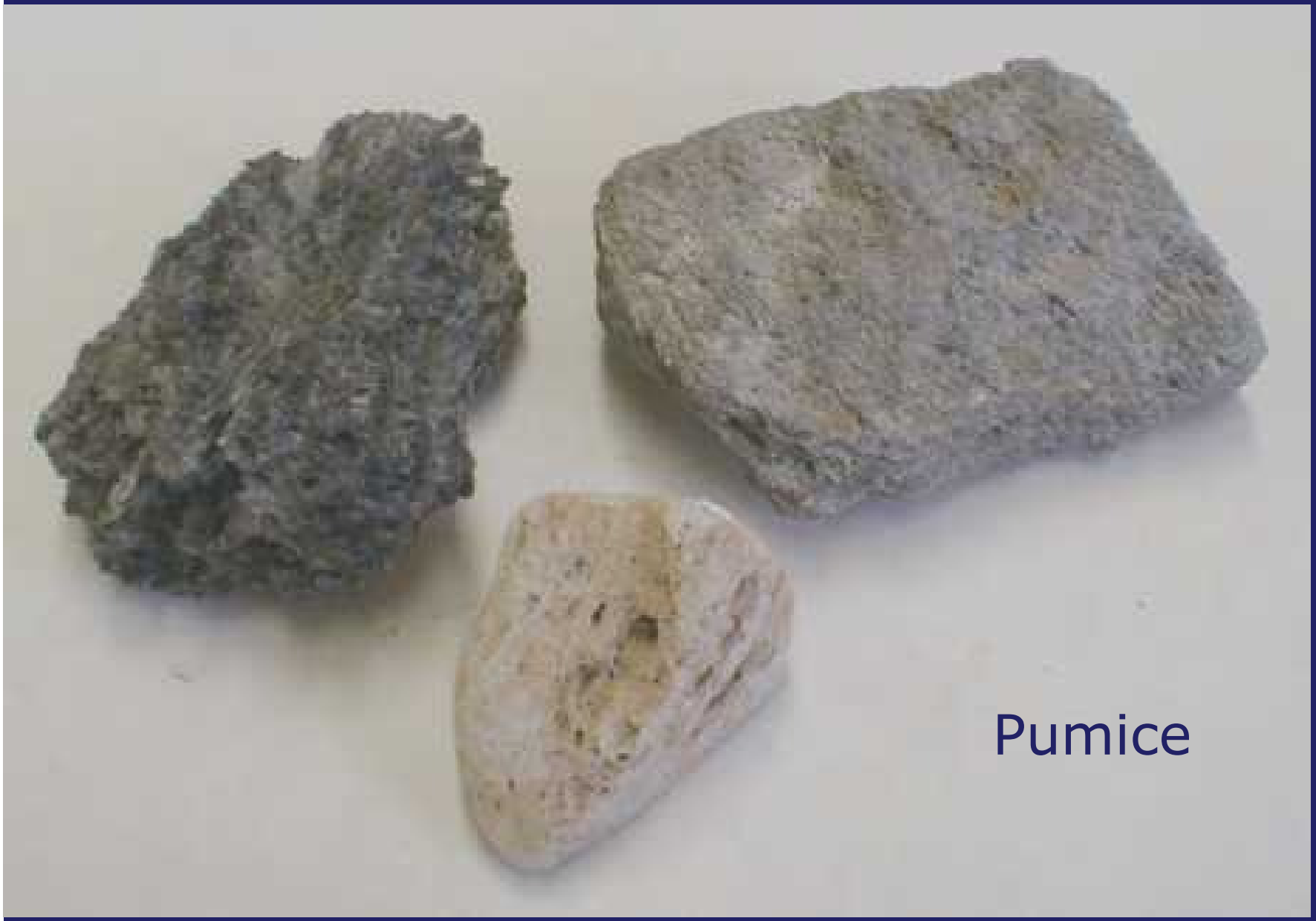
The Palisades, named for a stockade fence, border the Hudson River for 60 km (40 mi) opposite Manhatttan and Westchester County, NY. They are the eastern edge of an intrusive igneous sill of basaltic rock. The vertical cracks are columnar jointing which is also well illustrated at Giant's Causway in Northern Ireland and Devil's Postpile in eastern California.

TMcG



Basalt glass

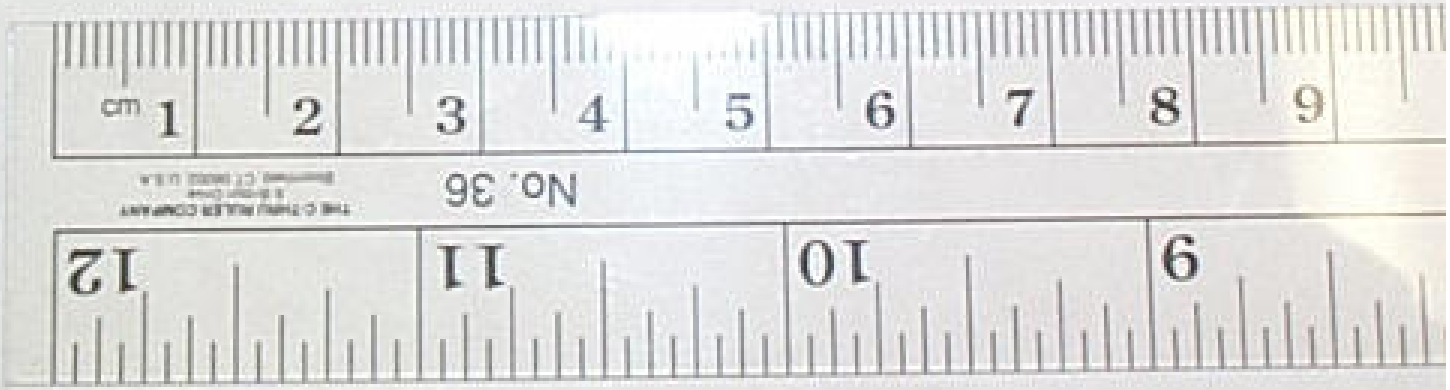

Pumice


Pumice

Rhyolite
(igneous)

Rhyolite

Vesicular rhyolite



andesite

basalt

basalt

vesicular basalt

Scoria

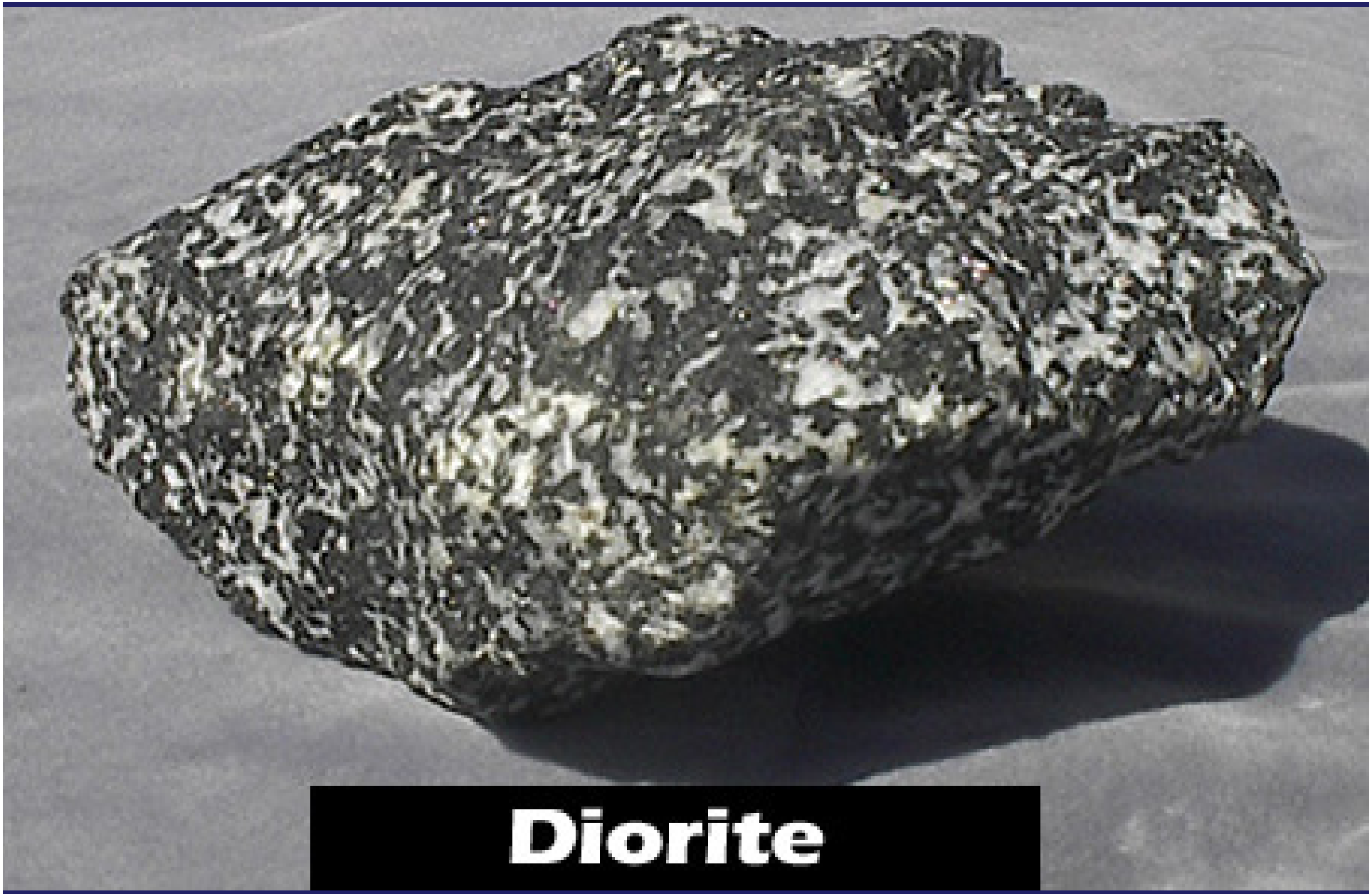
Intrusive Igneous rocks (from magma)


Granite

granite


HARRISON HIGH SCHOOL
HOME OF THE
HUSKIES
CLASSES OF 88 - 89


ISO



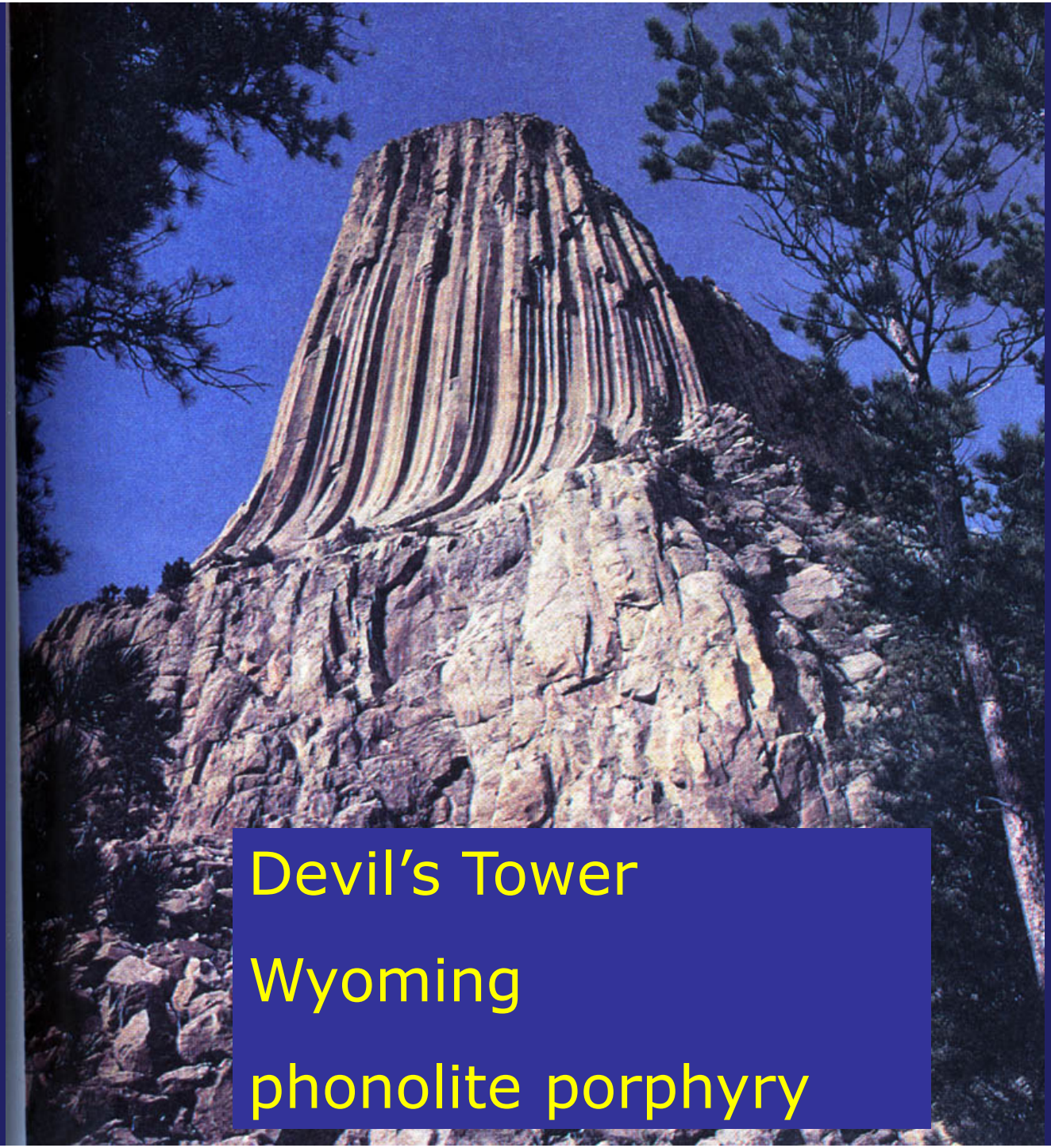
Diorite


Gabbro

peridotite


DUNITE

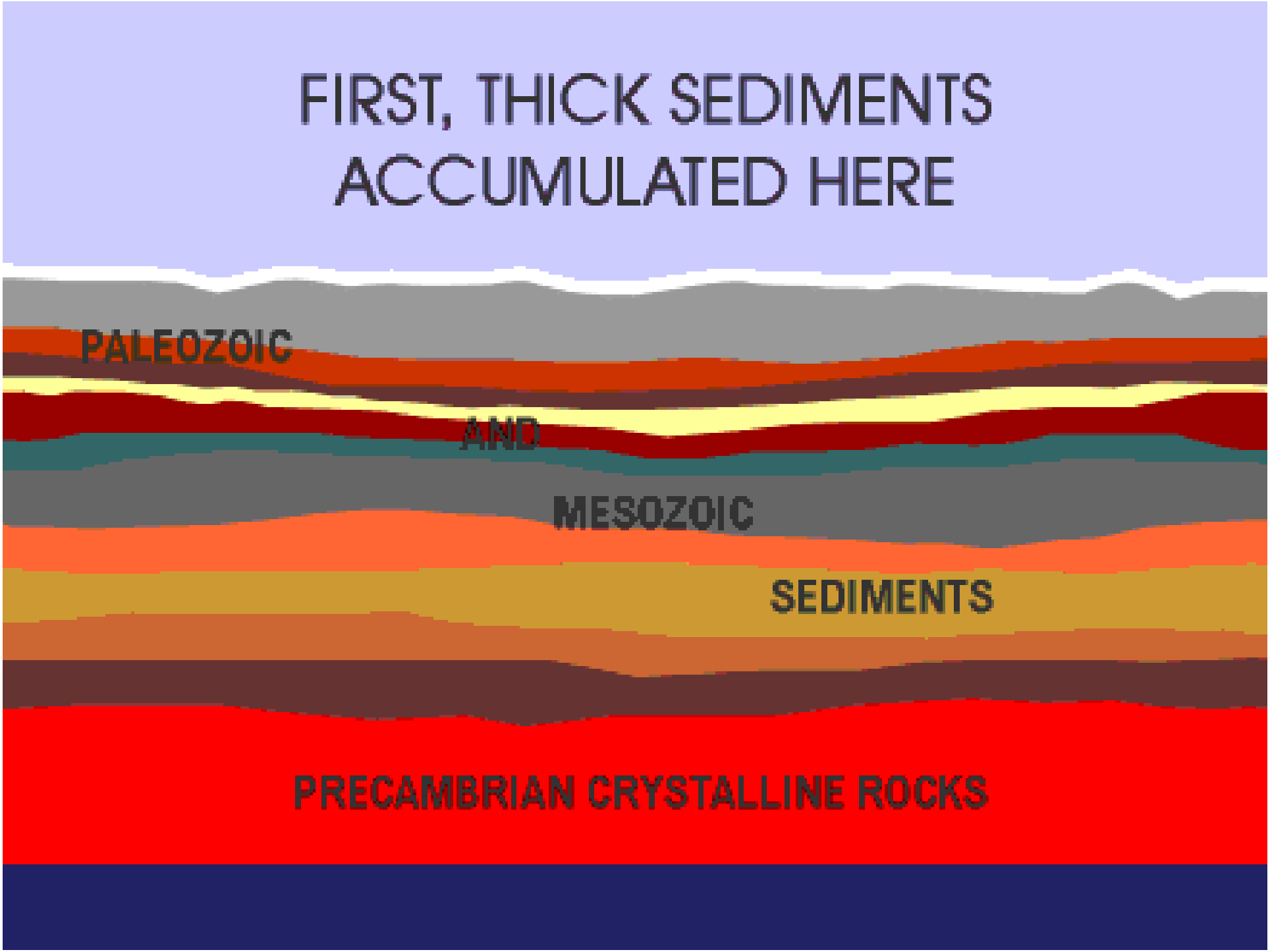
pegmatite

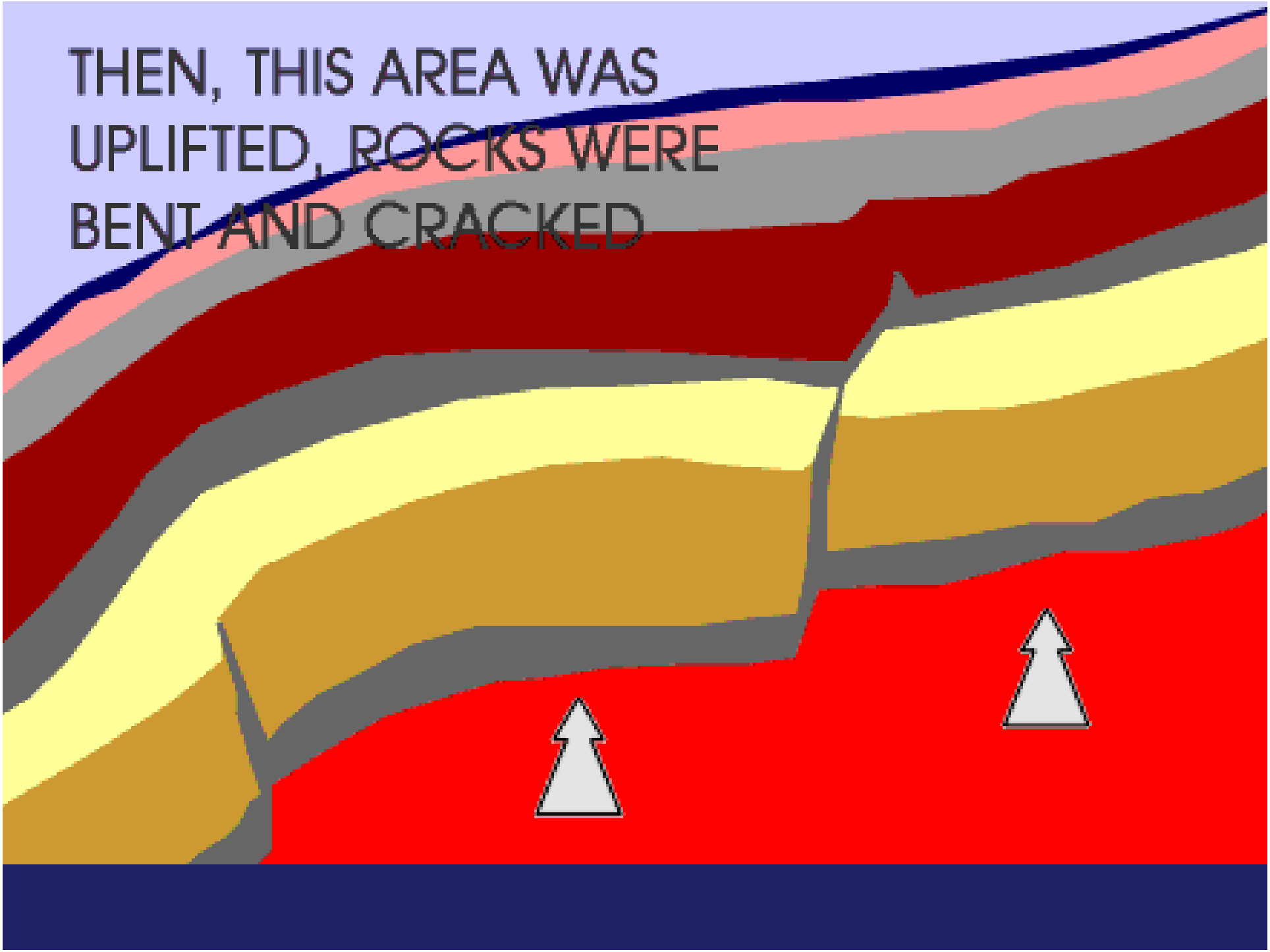


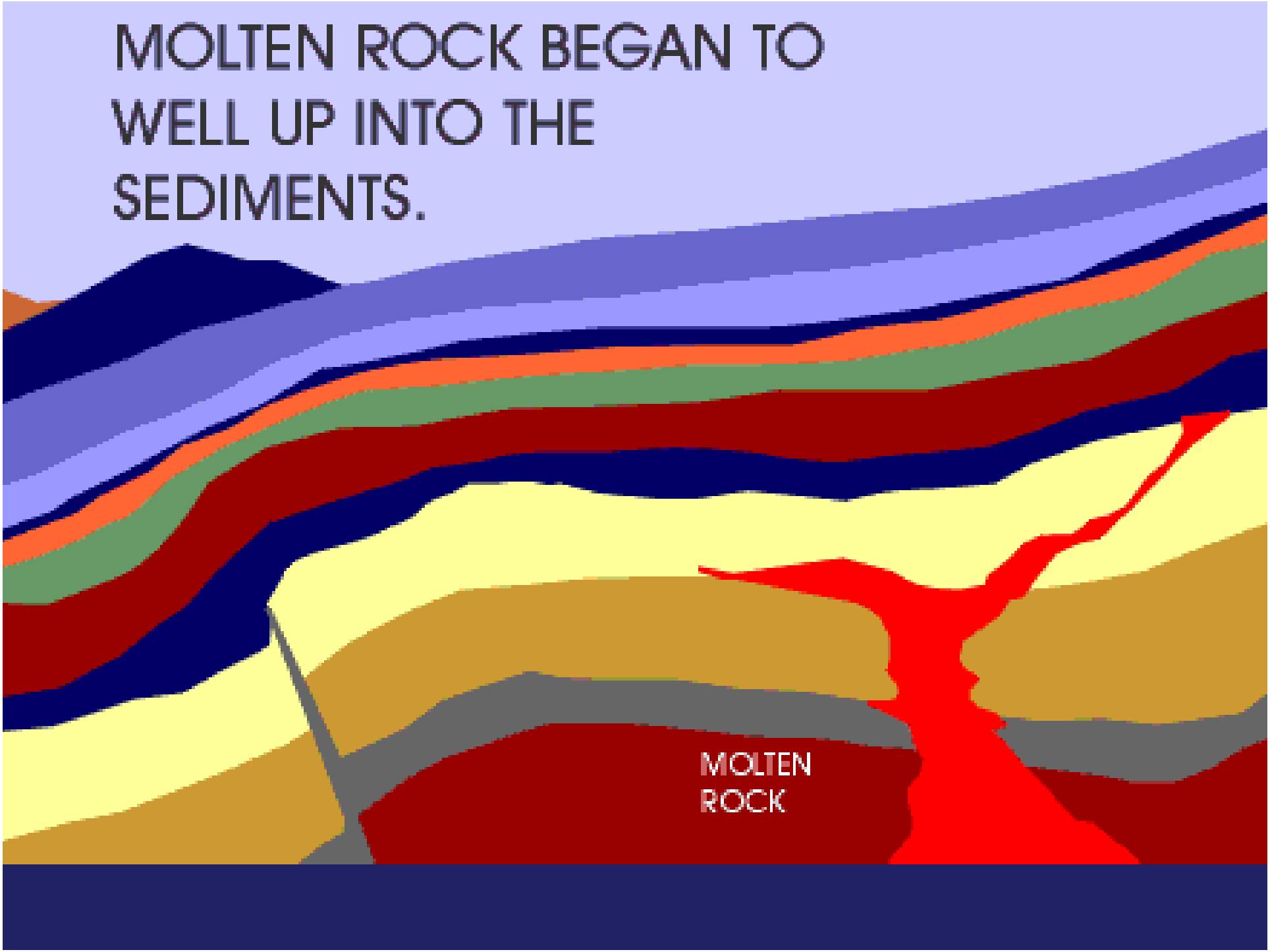
Devil’s Tower

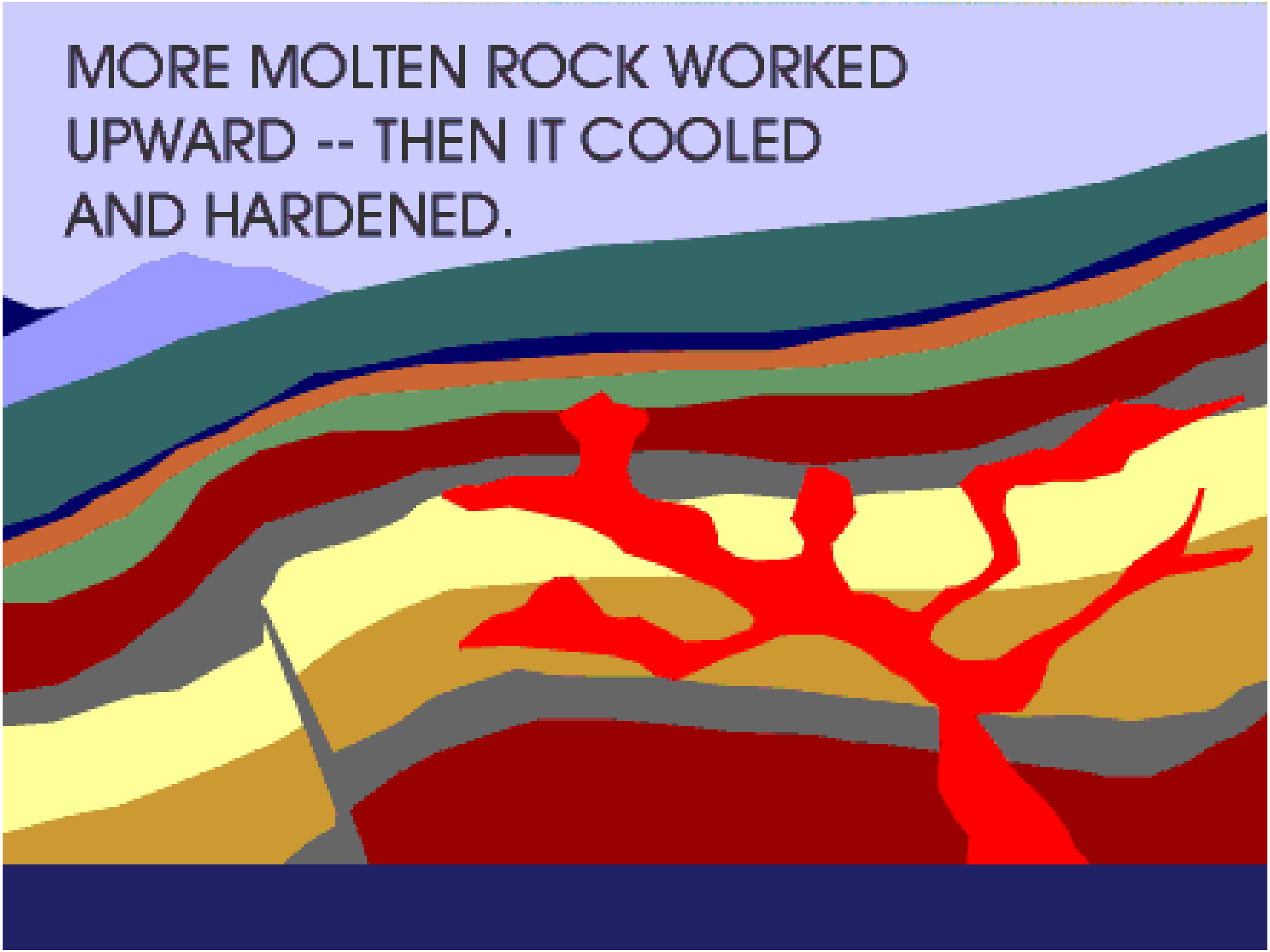
Wyoming

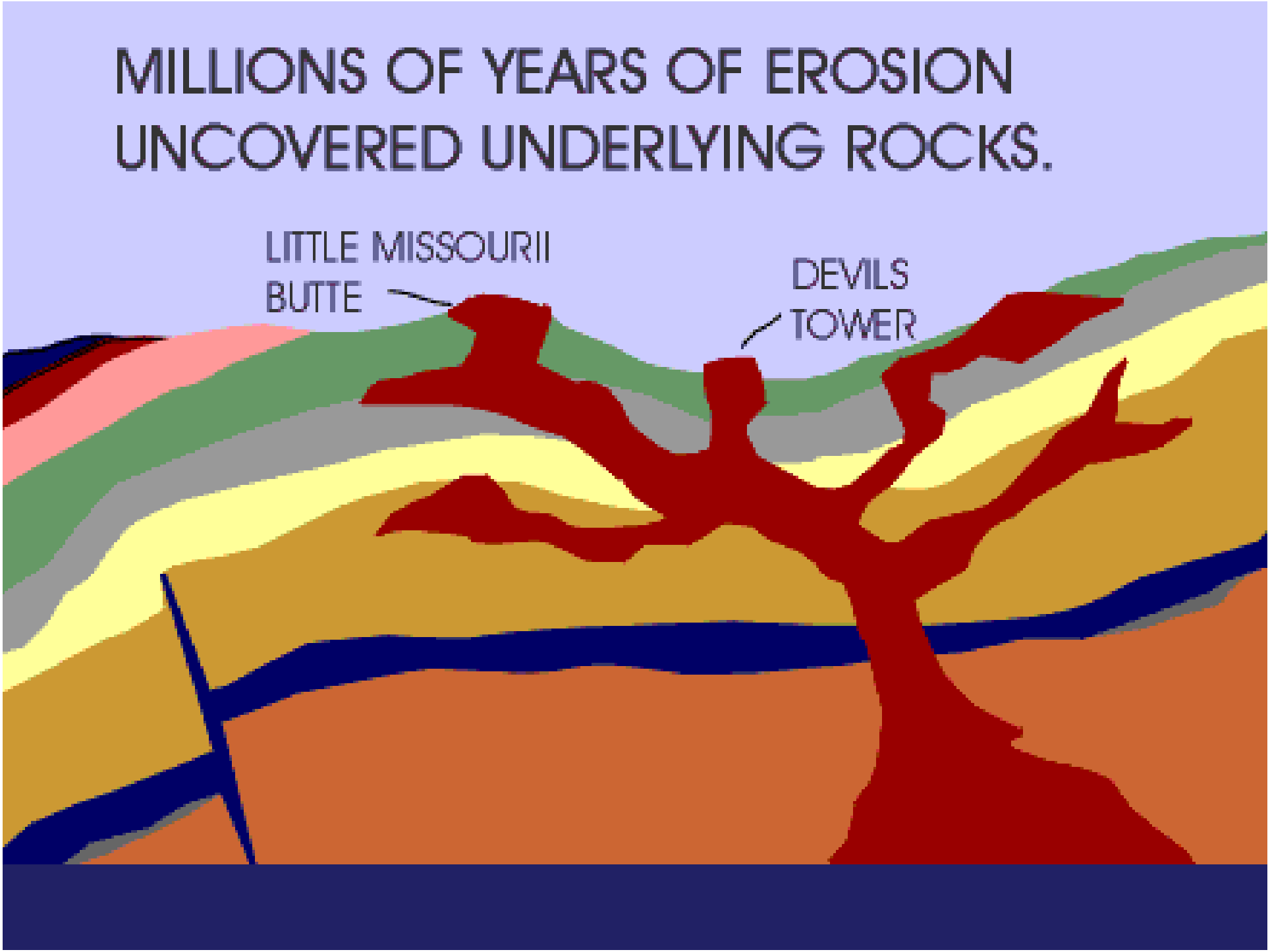
phonolite porphyry

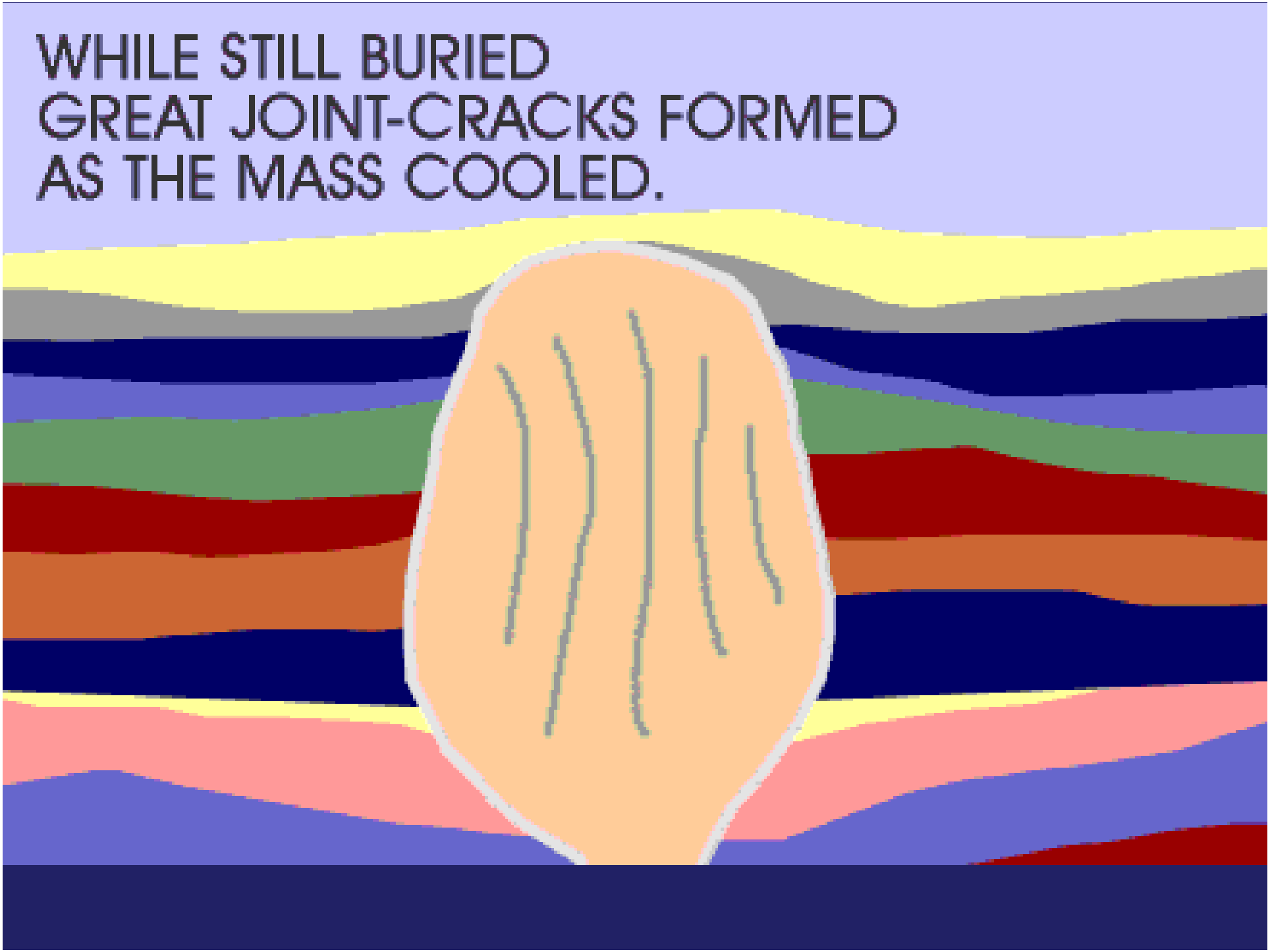

FIRST, THICK SEDIMENTS
ACCUMULATED HERE
PALEOZOIC
AND
MESOZOIC
SEDIMENTS
PRECAMBRIAN CRYSTALLINE ROCKS

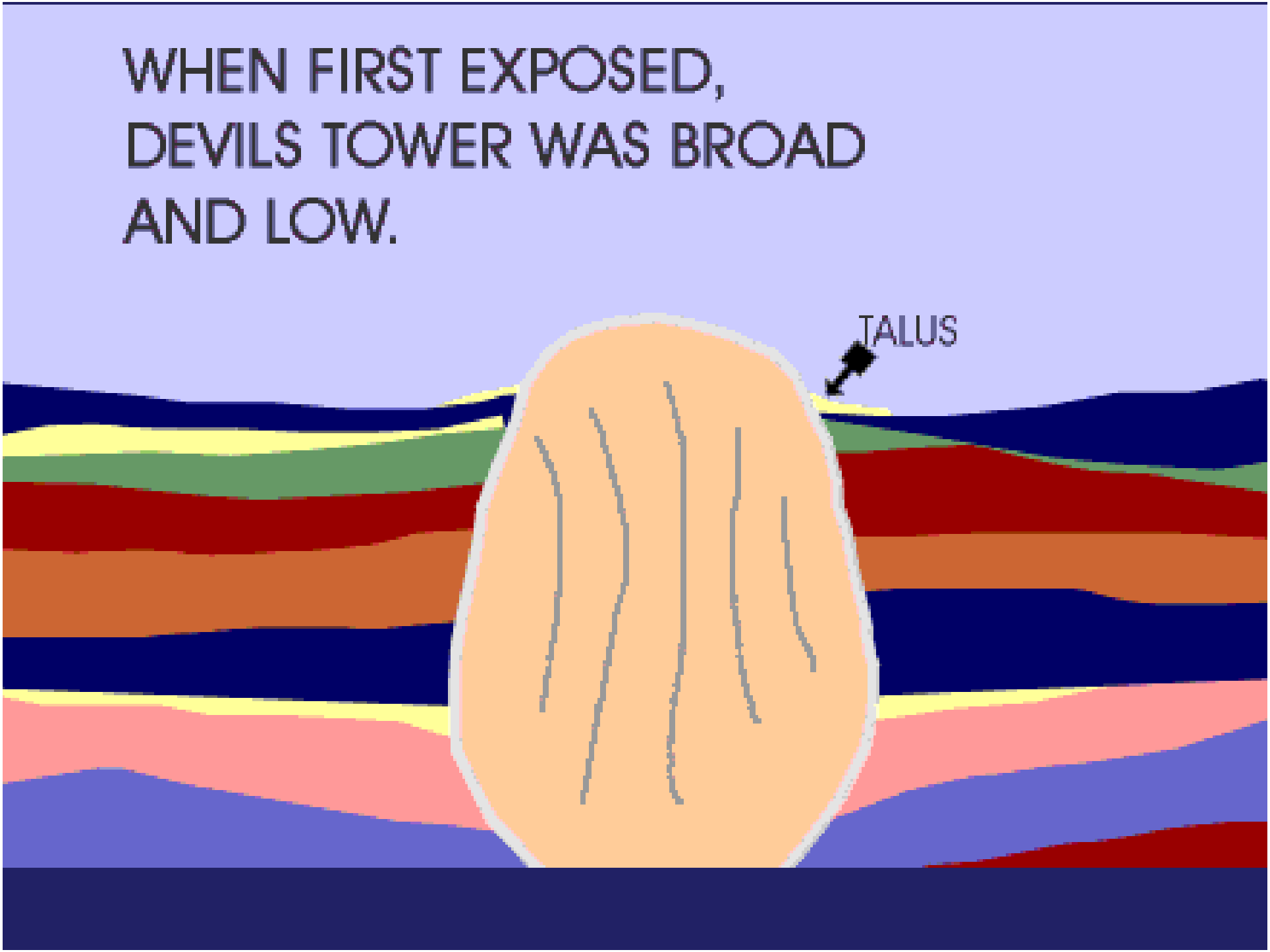

THEN, THIS AREA WAS
UPLIFTED, ROCKS WERE
BENT AND CRACKED

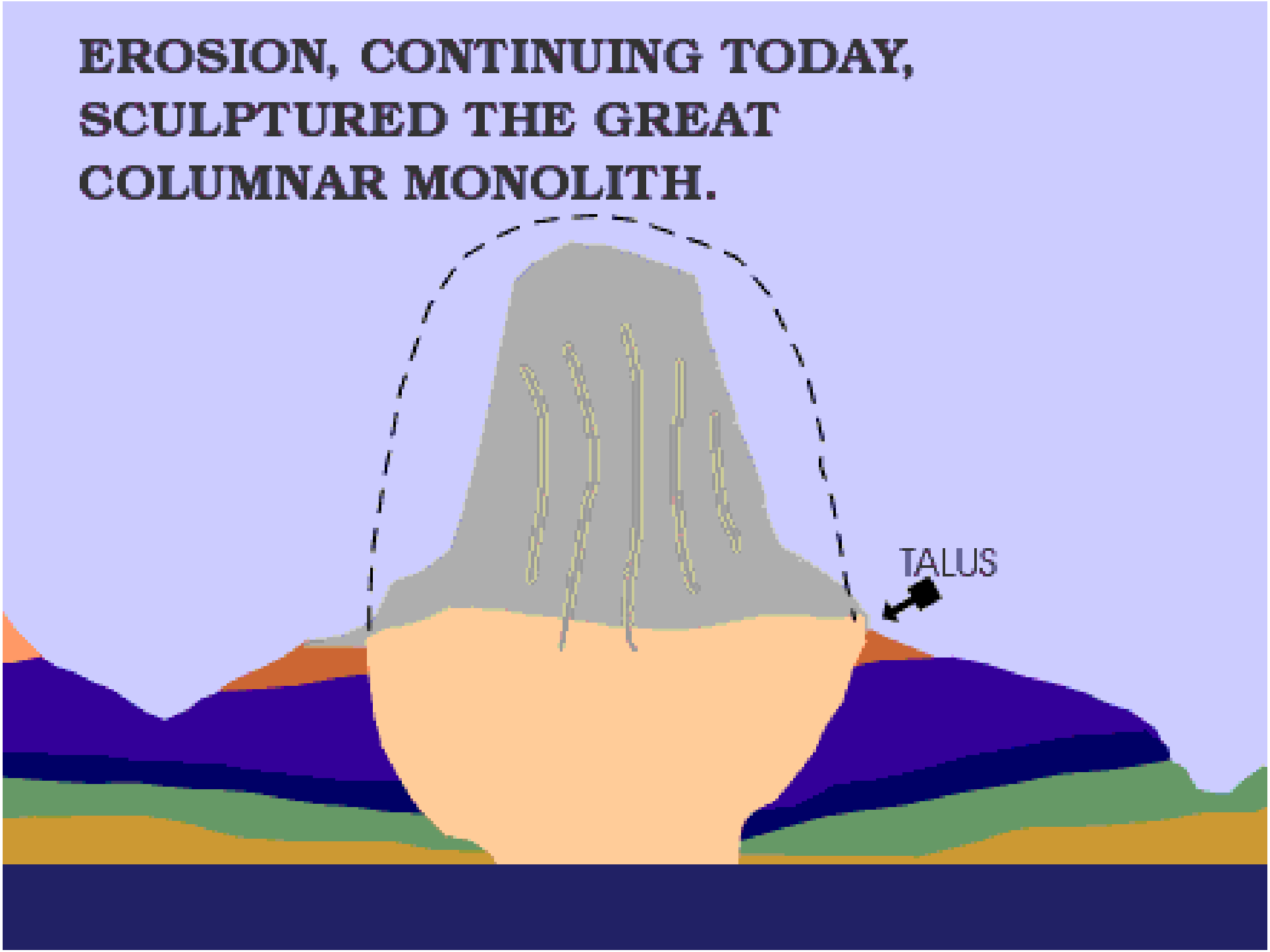

MOLTEN ROCK BEGAN TO WELL UP INTO THE SEDIMENTS.
MOLTEN ROCK

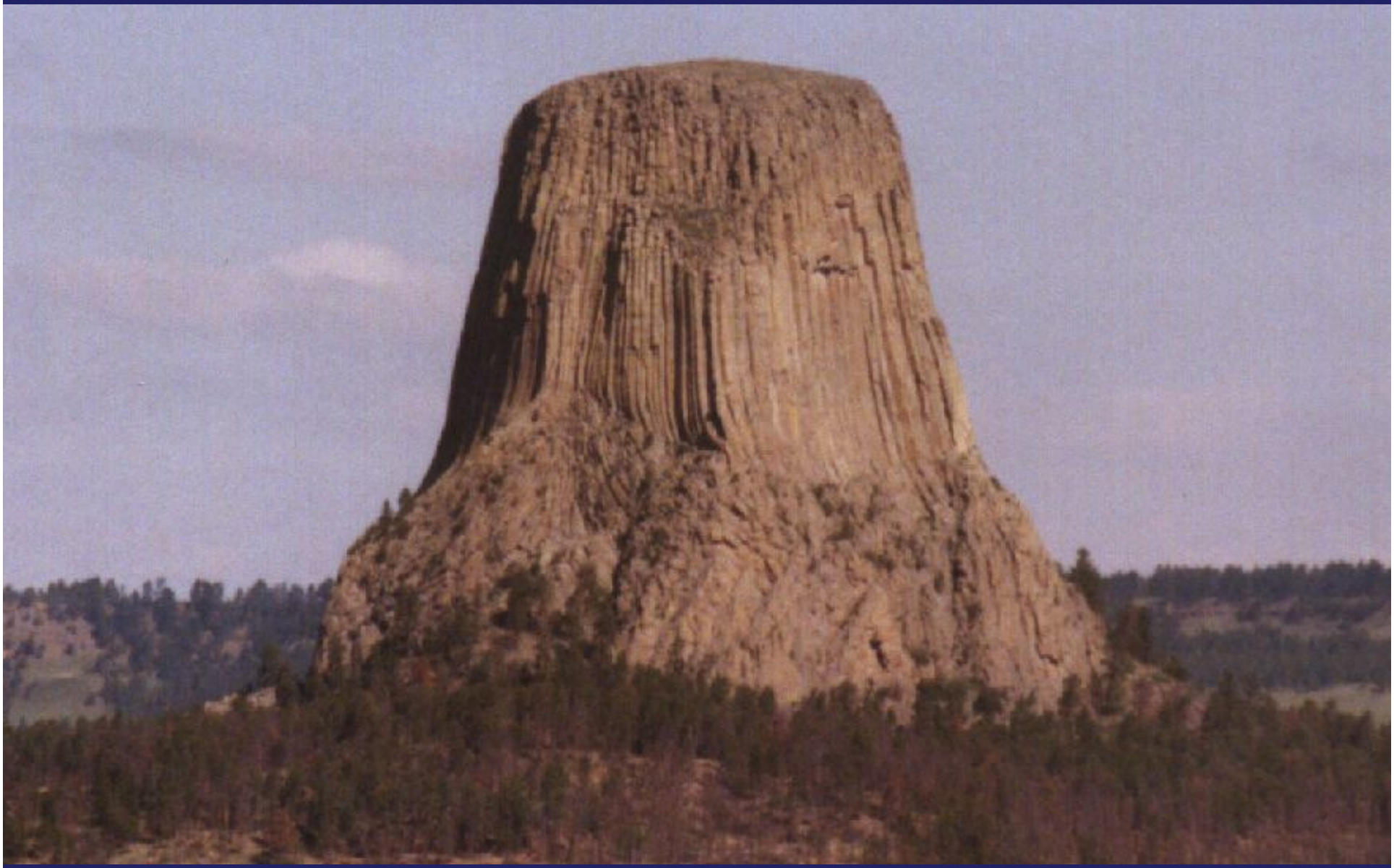

MORE MOLTEN ROCK WORKED
UPWARD -- THEN IT COOLED
AND HARDENED.


MILLIONS OF YEARS OF EROSION
UNCOVERED UNDERLYING ROCKS.
LITTLE MISSOURII
BUTTE
DEVILS
TOWER

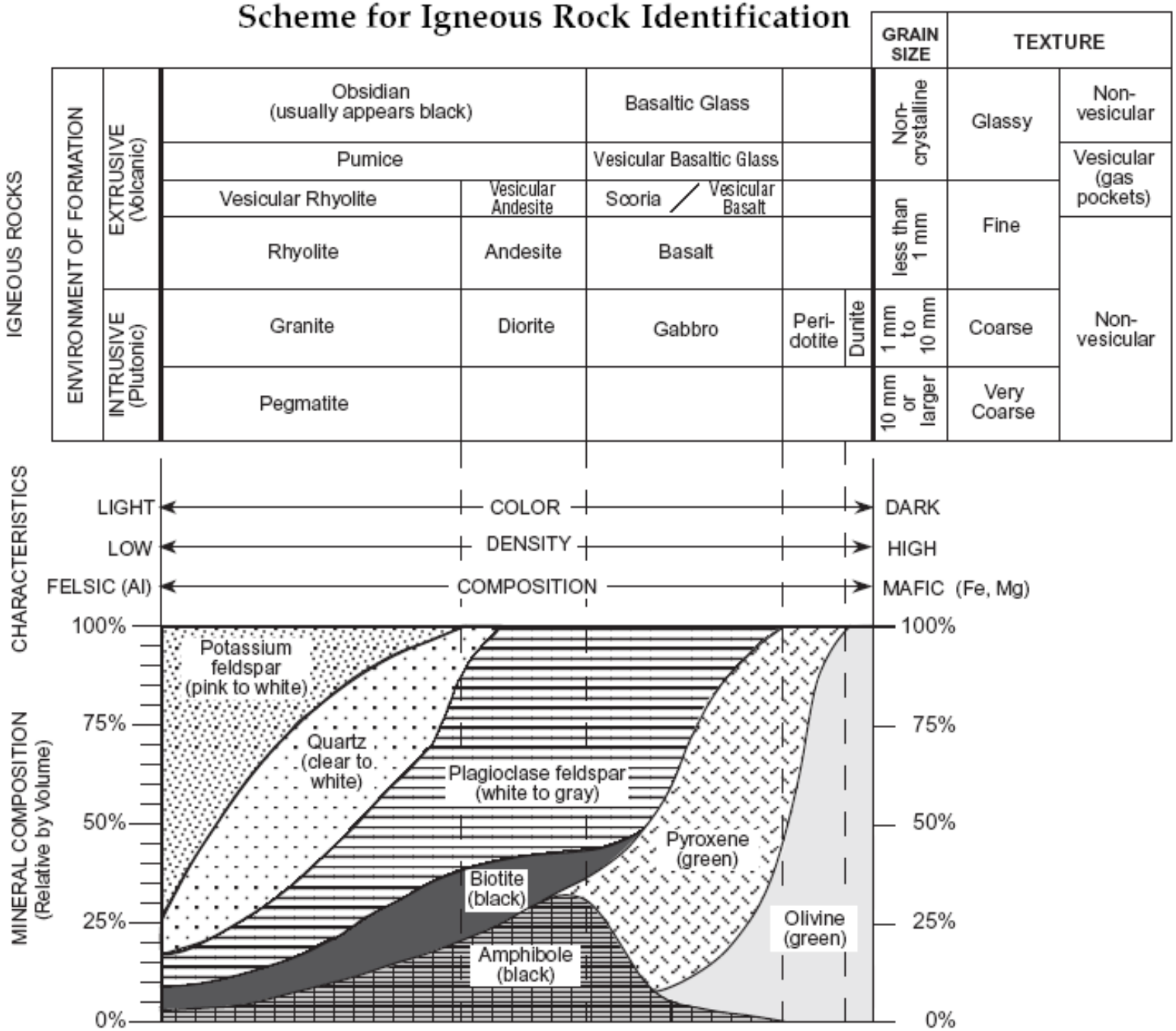

WHILE STILL BURIED
GREAT JOINT-CRACKS FORMED
AS THE MASS COOLED.


WHEN FIRST EXPOSED,
DEVILS TOWER WAS BROAD
AND LOW.
TALUS


EROSION, CONTINUING TODAY, SCULPTURED THE GREAT COLUMNAR MONOLITH.
TALUS



Scheme for Igneous Rock Identification



Do Now

Explain the difference between lava & magma. List the name of two igneous rocks in your explanation.

Sedimentary rocks

Sedimentary rocks

Research:

- How does the rock form?
- What is it made up of?
- What is it used for?
- Any other interesting facts?

Sedimentary rocks

-usually form near or underwater

-may contain fossils

-three types:

Three types:

Scheme for Sedimentary Rock Identification

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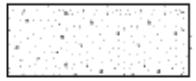
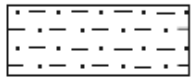
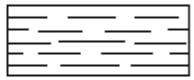
			Angular fragments	**Breccia**	
	Sand (0.006 to 0.2 cm)		Fine to coarse	**Sandstone**	
	Silt (0.0004 to 0.006 cm)		Very fine grain	**Siltstone**	
	Clay (less than 0.0004 cm)		Compact; may split easily	**Shale**	
CHEMICALLY AND/OR ORGANICALLY FORMED SEDIMENTARY ROCKS					
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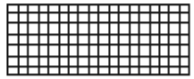
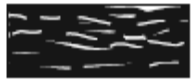
Crystalline	Fine to coarse crystals	Halite	Crystals from chemical precipitates and evaporites	**Rock salt**	
		Gypsum		**Rock gypsum**	
		Dolomite		**Dolostone**	
Crystalline or bioclastic	Microscopic to very coarse	Calcite	Precipitates of biologic origin or cemented shell fragments	**Limestone**	
Bioclastic		Carbon	Compacted plant remains	**Bituminous coal**	

Exit Quiz

List a few facts about two sedimentary rocks *other* than the one your group presented.

shale

sandstone

Three types:

1) Clastic

-made of cemented sediments

-classified according to the size of the grains (sediments)

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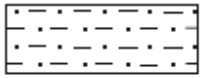
			Angular fragments	**Breccia**	
	Sand (0.006 to 0.2 cm)		Fine to coarse	**Sandstone**	
	Silt (0.0004 to 0.006 cm)		Very fine grain	**Siltstone**	
	Clay (less than 0.0004 cm)		Compact; may split easily	**Shale**	

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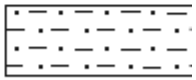
	Silt (0.0004 to 0.006 cm)		Very fine grain	**Siltstone**	
	Clay (less than 0.0004 cm)		Compact; may split easily	**Shale**	

Example #1: sand sized sediment, the rock is called Sandstone

Example #2: sediments of size 0.0004-0.006cm called Siltstone

Example #3: sediments of size 0.000000003 cm = Shale

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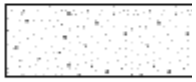
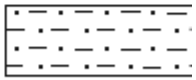
	Sand (0.006 to 0.2 cm)		Fine to coarse	**Sandstone**	
	Silt (0.0004 to 0.006 cm)		Very fine grain	**Siltstone**	
	Clay (less than 0.0004 cm)		Compact; may split easily	**Shale**	

But….

What if the rock is made of sand *and* silt sized particles mixed together???

Conglomerate (if the sediments are rounded) or Breccia (if the sediments are angular)

sandstone

conglomerate

Sandstone
(sedimentary)

Three types:

2) Crystalline

-made by chemical process such as evaporation and precipitation

example: rock candy

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	Varied	Gypsum		Rock Gypsum	
	Varied	Dolomite		Dolostone	


Limestone - Crystalline

Cleopatra’s Needle

Cleopatra's Needle In Egypt from 1500 B.C. to 1881

Over 3000 years!

Moved to Central Park in 1881

Three types:

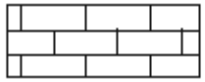
3) Bioclastic

-this rock was once alive

-made of pieces of living things such as plants or fish

-contain fossils

Fossil-an imprint or remain of a living thing

Crystalline or bioclastic	Microscopic to very coarse	Calcite	Precipitates of biologic origin or cemented shell fragments	**Limestone**	
Bioclastic		Carbon	Compacted plant remains	**Bituminous coal**	

Anthracite coal

fossil limestone

fossil limestone

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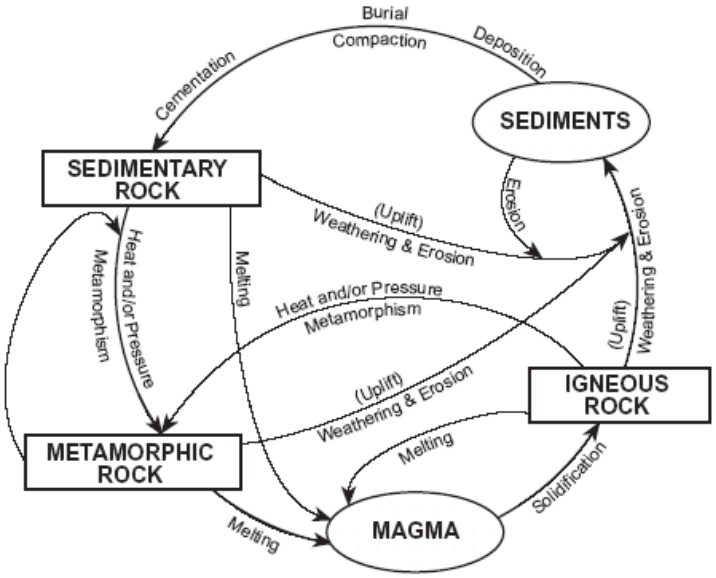
Rock Cycle in Earth's Crust



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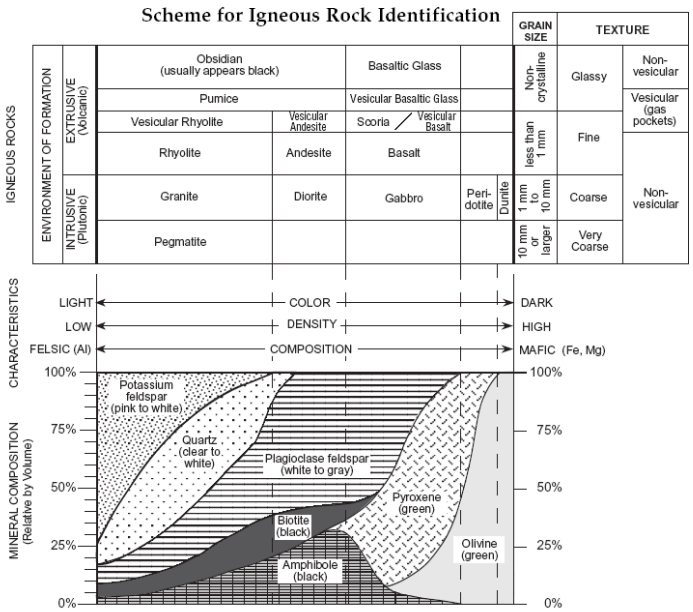

Scheme for Metamorphic Rock Identification

TEXTURE		GRAIN SIZE	COMPOSITION	TYPE OF METAMORPHISM	COMMENTS	ROCK NAME	MAP SYMBOL
FOLIATED	MINERAL ALIGNMENT	Fine	MICA, QUARTZ, FELDSPAR, AMPHIBOLE, GARNET, PYROXENE	Regional (Heat and pressure increases)	Low-grade metamorphism of shale	Slate	
		Fine to medium			Foliation surfaces shiny from microscopic mica crystals	Phyllite	
					Platy mica crystals visible from metamorphism of clay or feldspars	Schist	
	BAND-ING	Medium to coarse			High-grade metamorphism; mineral types segregated into bands	Gneiss	
NONFOLIATED		Fine	Carbon	Regional	Metamorphism of bituminous coal	Anthracite coal	
		Fine	Various minerals	Contact (heat)	Various rocks changed by heat from nearby magma/lava	Hornfels	
		Fine to coarse	Quartz	Regional or contact	Metamorphism of quartz sandstone	Quartzite	
			Calcite and/or dolomite		Metamorphism of limestone or dolostone	Marble	
		Coarse	Various minerals		Pebbles may be distorted or stretched	Metaconglomerate	

Metamorphic rocks

-rocks that change as a result of heat and/or pressure

-recrystallization of unmelted minerals

-harder and denser than other rock types

Characteristics:

1) May contain banding (zebra stripes)
   –this is an alignment of mineral crystals

Characteristics:

2) May have foliation-a distorted structure (wavy layers)

Two types:

1) Regional metamorphic rocks

Two types:

2) Contact metamorphic rocks

Scheme for Metamorphic Rock Identification

TEXTURE		GRAIN SIZE	COMPOSITION	TYPE OF METAMORPHISM	COMMENTS	ROCK NAME	MAP SYMBOL
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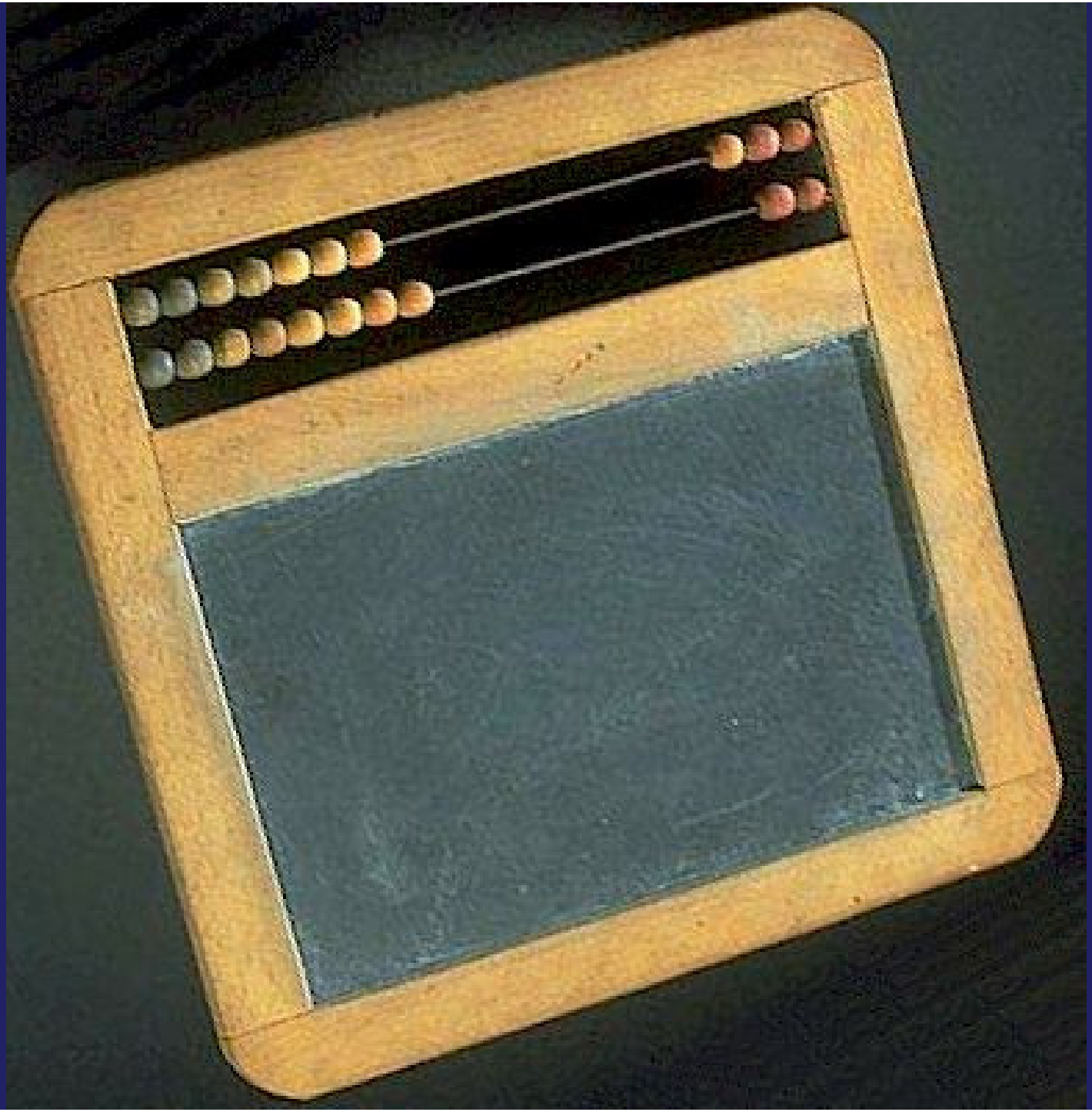
		Fine to medium	MICA, QUARTZ, FELDSPAR, AMPHIBOLE, GARNET		Foliation surfaces shiny from microscopic mica crystals	**Phyllite**	
					Platy mica crystals visible from metamorphism of clay or feldspars	**Schist**	
	BAND-ING	Medium to coarse	MICA, QUARTZ, FELDSPAR, AMPHIBOLE, GARNET, PYROXENE		High-grade metamorphism; mineral types segregated into bands	**Gneiss**	
NONFOLIATED		Fine	Carbon	Regional	Metamorphism of bituminous coal	**Anthracite coal**	
		Fine	Various minerals	Contact (heat)	Various rocks changed by heat from nearby magma/lava	**Hornfels**	
		Fine to coarse	Quartz	Regional or contact	Metamorphism of quartz sandstone	**Quartzite**	
			Calcite and/or dolomite		Metamorphism of limestone or dolostone	**Marble**	
		Coarse	Various minerals		Pebbles may be distorted or stretched	**Metaconglomerate**	

limestone

marble

shale

slate



In summary*(memorize):

1) Igneous rocks have:

-interlocking crystals (crystals that are connected)

-or glassy texture

2) Sedimentary rocks have:

-flat layers

-fossils

-cemented sediments

3) Metamorphic rocks have foliation (wavy layers) and/or banding (zebra stripes)

What type of rock is it and why?

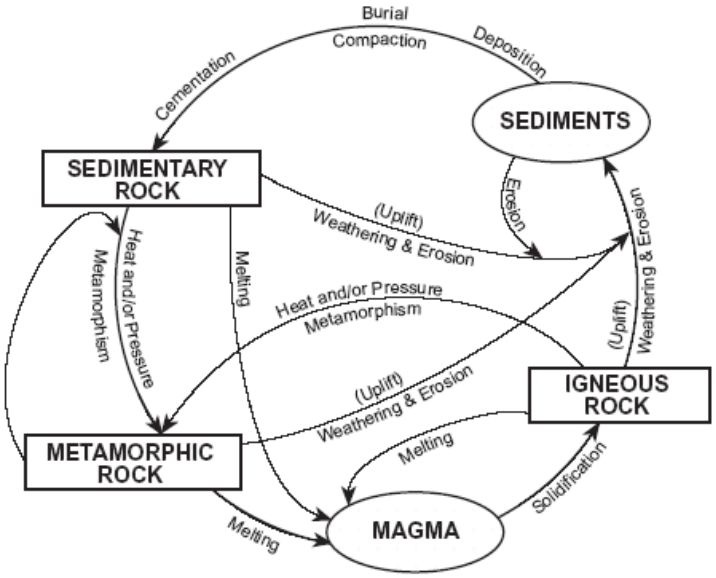
Properties of Common Minerals

LUSTER	HARD-NESS	CLEAVAGE	FRACTURE	COMMON COLORS	DISTINGUISHING CHARACTERISTICS	USE(S)	MINERAL NAME	COMPOSITION*
Metallic Luster	1–2	✓		silver to gray	black streak, greasy feel	pencil lead, lubricants	**Graphite**	C
	2.5	✓		metallic silver	very dense (7.6 g/cm^3), gray-black streak	ore of lead	**Galena**	PbS
	5.5–6.5		✓	black to silver	attracted by magnet, black streak	ore of iron	**Magnetite**	Fe_3O_4
	6.5		✓	brassy yellow	green-black streak, cubic crystals	ore of sulfur	**Pyrite**	FeS_2
Either	1–6.5		✓	metallic silver or earthy red	red-brown streak	ore of iron	**Hematite**	Fe_2O_3
Nonmetallic Luster	1	✓		white to green	greasy feel	talcum powder, soapstone	**Talc**	$Mg_3Si_4O_{10}(OH)_2$
	2		✓	yellow to amber	easily melted, may smell	vulcanize rubber, sulfuric acid	**Sulfur**	S
	2	✓		white to pink or gray	easily scratched by fingernail	plaster of paris and drywall	**Gypsum** (Selenite)	$CaSO_4 \cdot 2H_2O$
	2–2.5	✓		colorless to yellow	flexible in thin sheets	electrical insulator	**Muscovite Mica**	$KAl_3Si_3O_{10}(OH)_2$
	2.5	✓		colorless to white	cubic cleavage, salty taste	food additive, melts ice	**Halite**	NaCl
	2.5–3	✓		black to dark brown	flexible in thin sheets	electrical insulator	**Biotite Mica**	$K(Mg,Fe)_3$ $AlSi_3O_{10}(OH)_2$
	3	✓		colorless or variable	bubbles with acid	cement, polarizing prisms	**Calcite**	$CaCO_3$
	3.5	✓		colorless or variable	bubbles with acid when powdered	source of magnesium	**Dolomite**	$CaMg(CO_3)_2$
	4	✓		colorless or variable	cleaves in 4 directions	hydrofluoric acid	**Fluorite**	CaF_2
	5–6	✓		black to dark green	cleaves in 2 directions at 90°	mineral collections	**Pyroxene** (commonly Augite)	$(Ca,Na)(Mg,Fe,Al)(Si,Al)_2O_6$
	5.5	✓		black to dark green	cleaves at 56° and 124°	mineral collections	**Amphiboles** (commonly Hornblende)	$CaNa(Mg,Fe)_4(Al,Fe,Ti)_3Si_6O_{22}(O,OH)_2$
	6	✓		white to pink	cleaves in 2 directions at 90°	ceramics and glass	**Potassium Feldspar** (Orthoclase)	$KAlSi_3O_8$
	6	✓		white to gray	cleaves in 2 directions, striations visible	ceramics and glass	**Plagioclase Feldspar** (Na-Ca Feldspar)	$(Na,Ca)AlSi_3O_8$
	6.5		✓	green to gray or brown	commonly light green and granular	furnace bricks and jewelry	**Olivine**	$(Fe,Mg)_2SiO_4$
	7		✓	colorless or variable	glassy luster, may form hexagonal crystals	glass, jewelry, and electronics	**Quartz**	SiO_2
	7		✓	dark red to green	glassy luster, often seen as red grains in NYS metamorphic rocks	jewelry and abrasives	**Garnet** (commonly Almandine)	$Fe_3Al_2Si_3O_{12}$

*Chemical Symbols: Al = aluminum, C = carbon, Ca = calcium, Cl = chlorine, F = fluorine, Fe = iron, H = hydrogen, K = potassium, Mg = magnesium, Na = sodium, O = oxygen, Pb = lead, S = sulfur, Si = silicon, Ti = titanium

✓ = dominant form of breakage

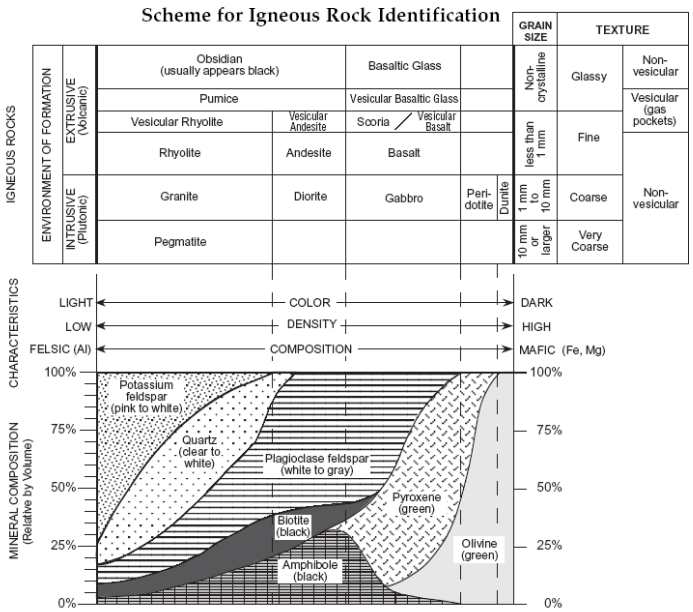
Rock Cycle in Earth's Crust



Scheme for Sedimentary Rock Identification

INORGANIC LAND-DERIVED SEDIMENTARY ROCKS					
TEXTURE	GRAIN SIZE	COMPOSITION	COMMENTS	ROCK NAME	MAP SYMBOL
Clastic (fragmental)	Pebbles, cobbles, and/or boulders embedded in sand, silt, and/or clay	Mostly quartz, feldspar, and clay minerals; may contain fragments of other rocks and minerals	Rounded fragments	Conglomerate	
			Angular fragments	Breccia	
	Sand (0.006 to 0.2 cm)		Fine to coarse	Sandstone	
	Silt (0.0004 to 0.006 cm)		Very fine grain	Siltstone	
	Clay (less than 0.0004 cm)		Compact; may split easily	Shale	
CHEMICALLY AND/OR ORGANICALLY FORMED SEDIMENTARY ROCKS					
TEXTURE	GRAIN SIZE	COMPOSITION	COMMENTS	ROCK NAME	MAP SYMBOL
Crystalline	Fine to coarse crystals	Halite	Crystals from chemical precipitates and evaporites	Rock salt	
		Gypsum		Rock gypsum	
		Dolomite		Dolostone	
Crystalline or bioclastic	Microscopic to very coarse	Calcite	Precipitates of biologic origin or cemented shell fragments	Limestone	
Bioclastic		Carbon	Compacted plant remains	Bituminous coal	

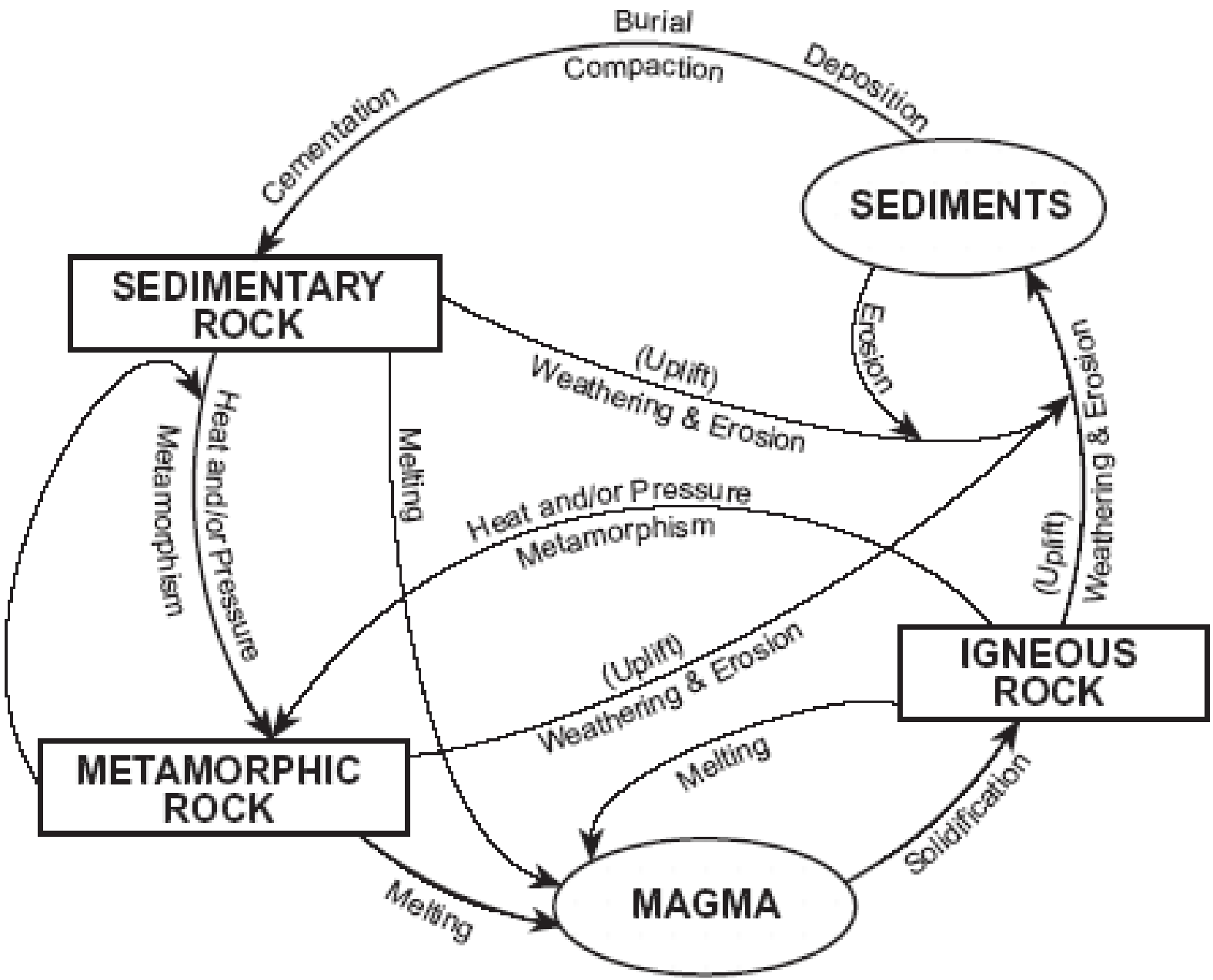
Scheme for Igneous Rock Identification



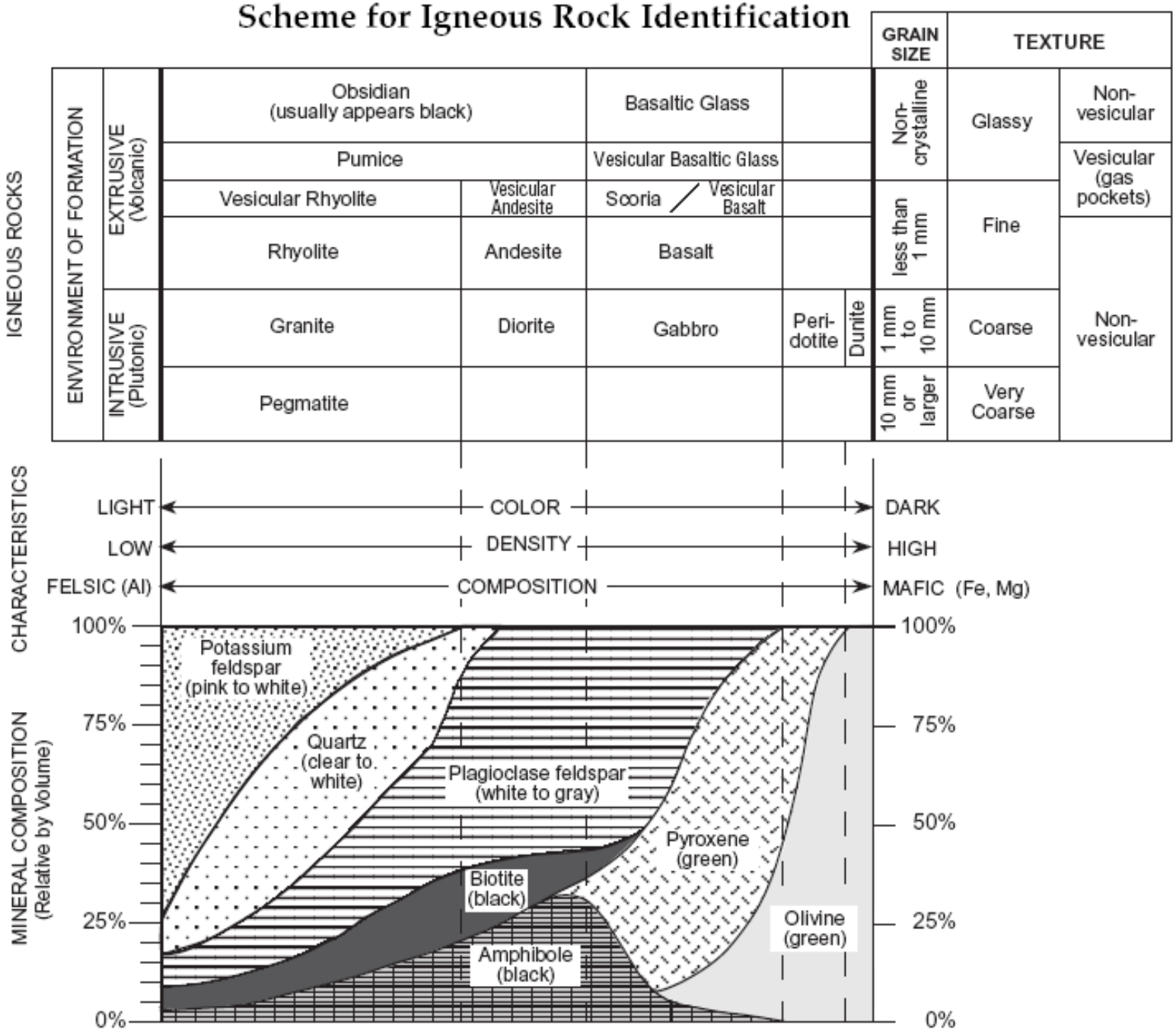
Scheme for Metamorphic Rock Identification

TEXTURE		GRAIN SIZE	COMPOSITION	TYPE OF METAMORPHISM	COMMENTS	ROCK NAME	MAP SYMBOL
FOLIATED	MINERAL ALIGNMENT	Fine	MICA, QUARTZ, FELDSPAR, AMPHIBOLE, GARNET, PYROXENE	Regional (Heat and pressure increases)	Low-grade metamorphism of shale	Slate	
		Fine to medium			Foliation surfaces shiny from microscopic mica crystals	Phyllite	
					Platy mica crystals visible from metamorphism of clay or feldspars	Schist	
	BAND-ING	Medium to coarse			High-grade metamorphism; mineral types segregated into bands	Gneiss	
NONFOLIATED		Fine	Carbon	Regional	Metamorphism of bituminous coal	Anthracite coal	
		Fine	Various minerals	Contact (heat)	Various rocks changed by heat from nearby magma/lava	Hornfels	
		Fine to coarse	Quartz	Regional or contact	Metamorphism of quartz sandstone	Quartzite	
			Calcite and/or dolomite		Metamorphism of limestone or dolostone	Marble	
		Coarse	Various minerals		Pebbles may be distorted or stretched	Metaconglomerate	

Rock Cycle in Earth's Crust



Scheme for Igneous Rock Identification



Scheme for Sedimentary Rock Identification

INORGANIC LAND-DERIVED SEDIMENTARY ROCKS					
TEXTURE	**GRAIN SIZE**	**COMPOSITION**	**COMMENTS**	**ROCK NAME**	**MAP SYMBOL**
Clastic (fragmental)	Pebbles, cobbles, and/or boulders embedded in sand, silt, and/or clay	Mostly quartz, feldspar, and clay minerals; may contain fragments of other rocks and minerals	Rounded fragments	**Conglomerate**	
			Angular fragments	**Breccia**	
	Sand (0.006 to 0.2 cm)		Fine to coarse	**Sandstone**	
	Silt (0.0004 to 0.006 cm)		Very fine grain	**Siltstone**	
	Clay (less than 0.0004 cm)		Compact; may split easily	**Shale**	
CHEMICALLY AND/OR ORGANICALLY FORMED SEDIMENTARY ROCKS					
TEXTURE	**GRAIN SIZE**	**COMPOSITION**	**COMMENTS**	**ROCK NAME**	**MAP SYMBOL**
Crystalline	Fine to coarse crystals	Halite	Crystals from chemical precipitates and evaporites	**Rock salt**	
		Gypsum		**Rock gypsum**	
		Dolomite		**Dolostone**	
Crystalline or bioclastic	Microscopic to very coarse	Calcite	Precipitates of biologic origin or cemented shell fragments	**Limestone**	
Bioclastic		Carbon	Compacted plant remains	**Bituminous coal**	

Scheme for Metamorphic Rock Identification

TEXTURE		GRAIN SIZE	COMPOSITION	TYPE OF METAMORPHISM	COMMENTS	ROCK NAME	MAP SYMBOL
FOLIATED	MINERAL ALIGNMENT	Fine	MICA	Regional (Heat and pressure increases)	Low-grade metamorphism of shale	**Slate**	
		Fine to medium	MICA, QUARTZ, FELDSPAR, AMPHIBOLE, GARNET		Foliation surfaces shiny from microscopic mica crystals	**Phyllite**	
					Platy mica crystals visible from metamorphism of clay or feldspars	**Schist**	
	BAND-ING	Medium to coarse	MICA, QUARTZ, FELDSPAR, AMPHIBOLE, GARNET, PYROXENE		High-grade metamorphism; mineral types segregated into bands	**Gneiss**	
NONFOLIATED		Fine	Carbon	Regional	Metamorphism of bituminous coal	**Anthracite coal**	
		Fine	Various minerals	Contact (heat)	Various rocks changed by heat from nearby magma/lava	**Hornfels**	
		Fine to coarse	Quartz	Regional or contact	Metamorphism of quartz sandstone	**Quartzite**	
			Calcite and/or dolomite		Metamorphism of limestone or dolostone	**Marble**	
		Coarse	Various minerals		Pebbles may be distorted or stretched	**Metaconglomerate**	

$$\text{Rate of change} = \frac{\text{change in value}}{\text{time}}$$

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

Heat energy gained during vaporization . . . . . 2260 J/g

Heat energy released during condensation . . . 2260 J/g

Density at 3.98°C . . . . . 1.0 g/mL

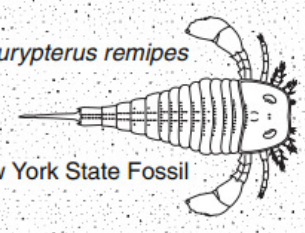
Average Chemical Composition of Earth's Crust, Hydrosphere, and Troposphere

ELEMENT (symbol)	CRUST		HYDROSPHERE	TROPOSPHERE
	Percent by mass	Percent by volume	Percent by volume	Percent by volume
Oxygen (O)	46.10	94.04	33.0	21.0
Silicon (Si)	28.20	0.88		
Aluminum (Al)	8.23	0.48		
Iron (Fe)	5.63	0.49		
Calcium (Ca)	4.15	1.18		
Sodium (Na)	2.36	1.11		
Magnesium (Mg)	2.33	0.33		
Potassium (K)	2.09	1.42		
Nitrogen (N)				78.0
Hydrogen (H)			66.0	
Other	0.91	0.07	1.0	1.0

2011 EDITION

This edition of the Earth Science Reference Tables should be used in the classroom beginning in the 2011–12 school year. The first examination for which these tables will be used is the January 2012 Regents Examination in Physical Setting/Earth Science.

Eurypterus remipes



New York State Fossil

Properties of Common Minerals

LUSTER	HARD-NESS	CLEAVAGE	FRACTURE	COMMON COLORS	DISTINGUISHING CHARACTERISTICS	USE(S)	MINERAL NAME	COMPOSITION*
Metallic Luster	1–2	✓		silver to gray	black streak, greasy feel	pencil lead, lubricants	**Graphite**	C
	2.5	✓		metallic silver	very dense (7.6 g/cm^3), gray-black streak	ore of lead	**Galena**	PbS
	5.5–6.5		✓	black to silver	attracted by magnet, black streak	ore of iron	**Magnetite**	Fe_3O_4
	6.5		✓	brassy yellow	green-black streak, cubic crystals	ore of sulfur	**Pyrite**	FeS_2
Either	1–6.5		✓	metallic silver or earthy red	red-brown streak	ore of iron	**Hematite**	Fe_2O_3
Nonmetallic Luster	1	✓		white to green	greasy feel	talcum powder, soapstone	**Talc**	$Mg_3Si_4O_{10}(OH)_2$
	2		✓	yellow to amber	easily melted, may smell	vulcanize rubber, sulfuric acid	**Sulfur**	S
	2	✓		white to pink or gray	easily scratched by fingernail	plaster of paris and drywall	**Gypsum** (Selenite)	$CaSO_4 \cdot 2H_2O$
	2–2.5	✓		colorless to yellow	flexible in thin sheets	electrical insulator	**Muscovite Mica**	$KAl_3Si_3O_{10}(OH)_2$
	2.5	✓		colorless to white	cubic cleavage, salty taste	food additive, melts ice	**Halite**	NaCl
	2.5–3	✓		black to dark brown	flexible in thin sheets	electrical insulator	**Biotite Mica**	$K(Mg,Fe)_3$ $AlSi_3O_{10}(OH)_2$
	3	✓		colorless or variable	bubbles with acid	cement, polarizing prisms	**Calcite**	$CaCO_3$
	3.5	✓		colorless or variable	bubbles with acid when powdered	source of magnesium	**Dolomite**	$CaMg(CO_3)_2$
	4	✓		colorless or variable	cleaves in 4 directions	hydrofluoric acid	**Fluorite**	CaF_2
	5–6	✓		black to dark green	cleaves in 2 directions at 90°	mineral collections	**Pyroxene** (commonly Augite)	$(Ca,Na)(Mg,Fe,Al)(Si,Al)_2O_6$
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	7		✓	dark red to green	glassy luster, often seen as red grains in NYS metamorphic rocks	jewelry and abrasives	**Garnet** (commonly Almandine)	$Fe_3Al_2Si_3O_{12}$

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✓ = dominant form of breakage