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Metamorphism & Metamorphic Rock

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What is different?





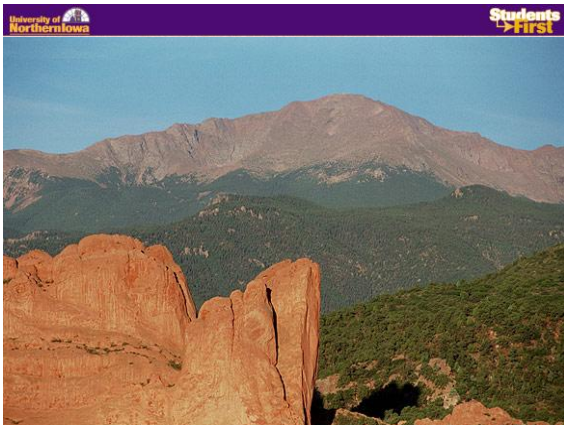
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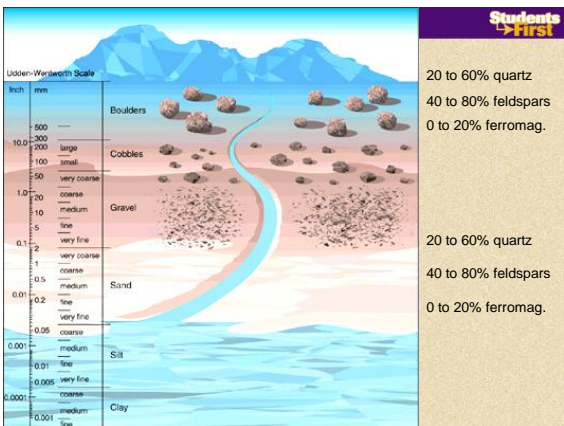
FIGURE 8.11

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Making a Metamorphic Rock





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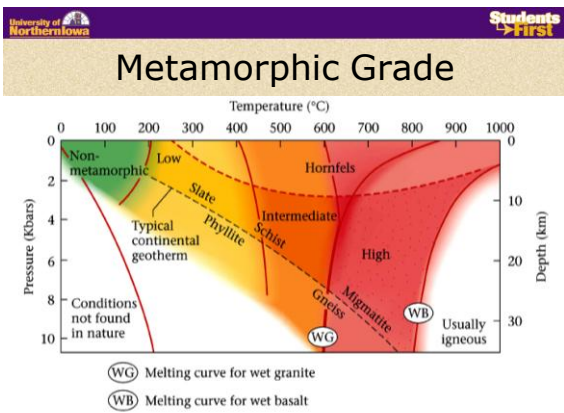
Metamorphosed Granite or Shale



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Temperature

- The heat comes from
 - Depth
 - Magma



PROTOLITH	LOW	INTERMEDIATE	HIGH	PARTIAL MELTING
Basalt (mafic)	Greenschist	Amphibolite	Mafic granulite	
	Zeolite Chlorite No Al	Epidote Amphibole	Al Garnet Pyroxene	
Shale (pelitic)	Slate Phyllite	Schist	Gneiss	Migmatite
Clay	Chlorite	Quartz/Feldspar Muscovite Biotite Garnet Staurolite Kyanite	Sillimanite	

FIGURE 8.17

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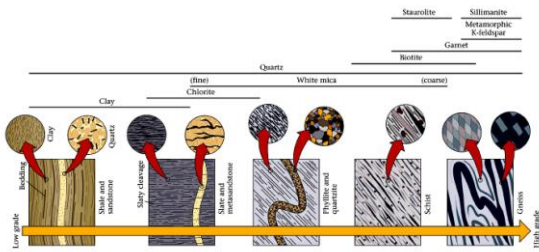
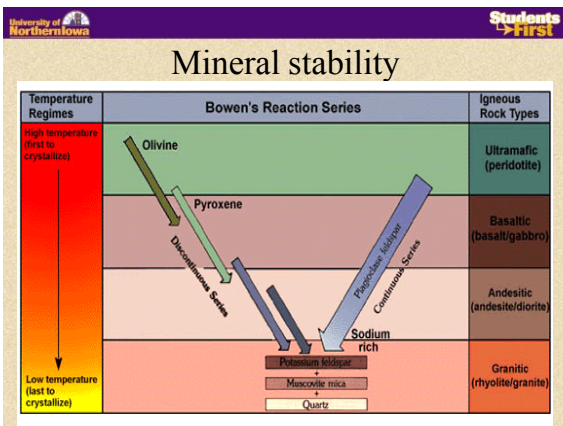


FIGURE 8.18

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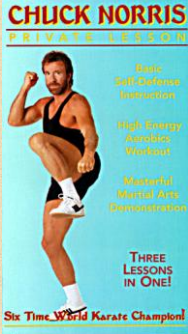
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Pressure

- Lithostatic pressure
- Pressure Gradient
- Minerals formed at great depths vs. shallow depths

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Stress vs. Strain



CHUCK NORRIS
PRIVATE LESSON

- Basic Self-Defense Instruction
- High Energy Karate Workout
- Essential Martial Arts Demonstration

THREE LESSONS IN ONE!

Six Time World Karate Champion

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Differential Stress

- Directions & Intensities
- Compressive stress
- Shear stress

= Alignment of crystals

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Foliation

- Minerals crystallize out
 - parallel to the direction of differential stress
 - perpendicular to the compressional stress

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Fluids

- Hot water (vapor)
- Source
 - Trapped and released from pore spaces
 - Condensation of a cooling magma
- A catalyst

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Time

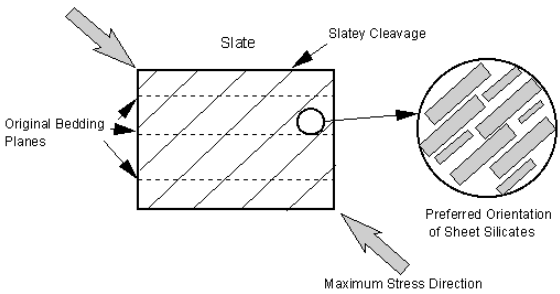
- Difficult to replicate P and T in lab

Metamorphic Textures

- Slaty Cleavage
- Schistose
- Gneissic

Slaty Cleavage

- Flat parallel fracture planes
 - NOT parallel to the original bedding.
- Occurs often in fine-grained rocks
 - Shale/slate



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Schistosity

- The alignment of platy minerals (e.g. micas)
- Reflective luster
- Common in coarse-grained rocks that have been strongly deformed.

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Schistosity

Quartz & Feldspar

Schist

Preferred Orientation of Sheet Silicates

Maximum Stress Direction

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Metamorphic facies

Diagenesis

Zeolite

Greenachian

Amphibolite

Granulite

Eclogite

Not found in nature

Not found in nature

① Contact (thermal) metamorphism

② Volcanic arc

③ Collisional mountain belt

④ Stable continent

⑤ Accretionary prism

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Metamorphic environments

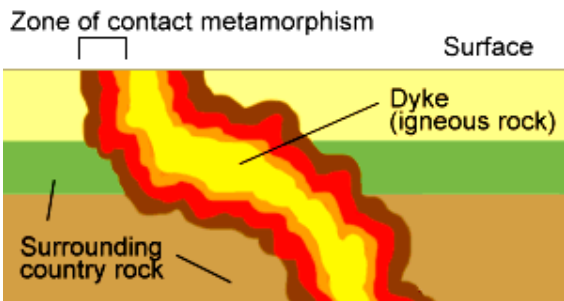
Contact Vs. Regional

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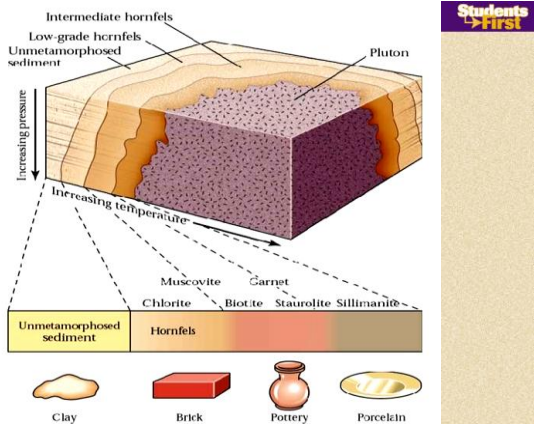
Contact metamorphism

Controlling factors

- High temperature
- Low pressure



Contact Metamorphism

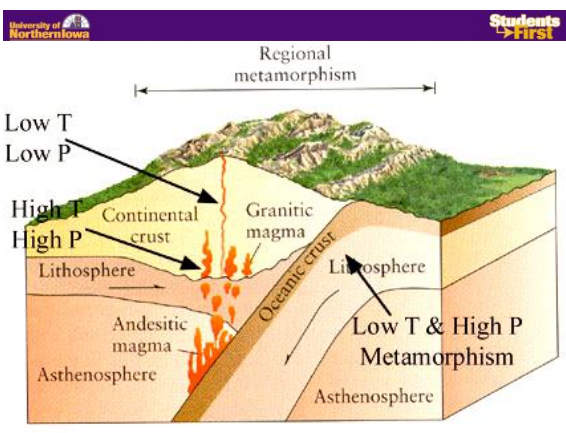


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Regional Metamorphism

- Large areas (think big)
- Variable temperatures and pressures
- Foliated



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