Last Time

Contact Metamorphism
A) Metamorphic Aureoles
B) Isograds
C) Index minerals and metamorphic grade
Contact Metamorphism

- Heat only
- Induced by hot intrusions
- Metamorphic aureoles

http://academic.brooklyn.cuny.edu/geology/grocha/monument/images/metheat.gif
Contact Metamorphism

- Metamorphic grade decreases from the intrusion into the country rock
Contact metamorphism is commonly **very** obvious in outcrop.

http://z.about.com/d/geology/1/0/A/z/contactmet500.jpg
Contact Metamorphism

Marble

Hornfels

Sill

Shale

Limestone

http://z.about.com/d/geology/1/0/A/z/contactmet500.jpg

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Contact Metamorphism

Metamorphic Isograds
Isograds

Isograds around the Kangmar Dome of Tibet

Contact Metamorphism

http://www.geol.ucsb.edu/faculty/hacker/geo102C/lectures/KangmarIsograds.jpg
Isograds

Isograds in Scotland

Regional Metamorphism

http://www.geol.lsu.edu/henry/Geology3041
Index Minerals (Felsic rocks)
Important observation: Amphibole only forms from parent rocks rich in Fe and Mg. Therefore the parent rock of most amphibolites is basalt.
Today’s Agenda

Last bit about Metamorphism

A) Metamorphic Facies
B) Retrograde Metamorphism
C) Shock Metamorphism

Web notes 29A: Metamorphic Facies
Web notes 29B: Retrograde Metamorphism
Metamorphic Facies
Metamorphic Facies

The Problem:
Parent rock $\rightarrow$ High Grade Metamorphic rock

Shale
Rhyolite $\rightarrow$ (granite) Gneiss
Granite
Metamorphic Facies

The Problem:
Parent rock → High Grade Metamorphic rock

Shale
Rhyolite (granite) Gneiss
Granite

The Solution:
Consider conditions of pressure and temperature rather than parent rock composition
Metamorphic Facies

Lowest Grade

Highest Grade

Partial melting

Pressure

Low

High

Temperature

Low

High
Metamorphic Facies

Temperature

Low		High

Pressure

Low		High

Zeolite facies

Partial melting
Metamorphic Facies

- Temperature
- Pressure

- Zeolite facies
- Hornfels facies

Partial melting
Metamorphic Facies

Temperature

Low High

Pressure

Low High

Zeolite facies

Hornfels facies

Blue schist

Partial melting
Metamorphic Facies

Temperature

Pressure

Low

High

Zeolite facies

Hornfels facies

Greenschist

Blue schist

Partial melting
Metamorphic Facies

Temperature

Pressure

Low

High

Zeolite facies

Hornfels facies

Greenschist

Amphibolite

Granulite

Partial melting
Metamorphic Facies

- Zeolite facies
- Greenschist
- Blue schist
- Amphibolite
- Granulite
- Eclogite facies
- Hornfels facies

Temperature

Pressure
Metamorphic Facies

- Zeolite facies
- Hornfels facies
- Slate
- Phyllite
- Schist
- Greenschist
- Amphibolite
- Granulite
- Gneiss
- Eclogite facies

Temperature

Pressure

Partial melting
Temperature

Pressure

Low

High

Metamorphic Facies

Zeolite facies

Hornfels facies

Greenschist

Amphibolite

Granulite

Eclogite facies

Slate

Phyllite

Schist

Blue schist

Gneiss

Partial melting
Metamorphic Facies

Temperature

Low  High

Pressure

Low  High

Burial curve (prograde metamorphism)

Partial melting
Metamorphic Facies

Temperature

Pressure

Low

High

Zeolite facies

Hornfels facies

Greenschist

Amphibolite

Granulite

Eclogite facies

phylite

slate

gneiss

Partial melting

High
Metamorphic Facies

Temperature

Pressure

Low

High

Partial melting

Burial curve

(contact metamorphism)

(Regional metamorphism subduction)
Metamorphic Facies

Temperature

Pressure

Low

High

Partial melting

Retrograde metamorphism

Burial curve (prograde metamorphism)
One More Type of Metamorphism

• Shock metamorphism: caused by high energy impacts (e.g., asteroids)
Today’s Homework

1. Start Studying for finals (word list 3 is up)
2. Rock/mineral assignment due Friday by 5:00 PM

Next Time

1. Mountain Building part 1

GY 302 Poster Session. Next Tuesday 1:00-3:00PM (Bonus)
Rock and Gem Show Thanksgiving weekend (Bonus)
proof of attendance required for both bonuses
GY 111: Physical Geology

Lecture 28: Metamorphic Facies

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