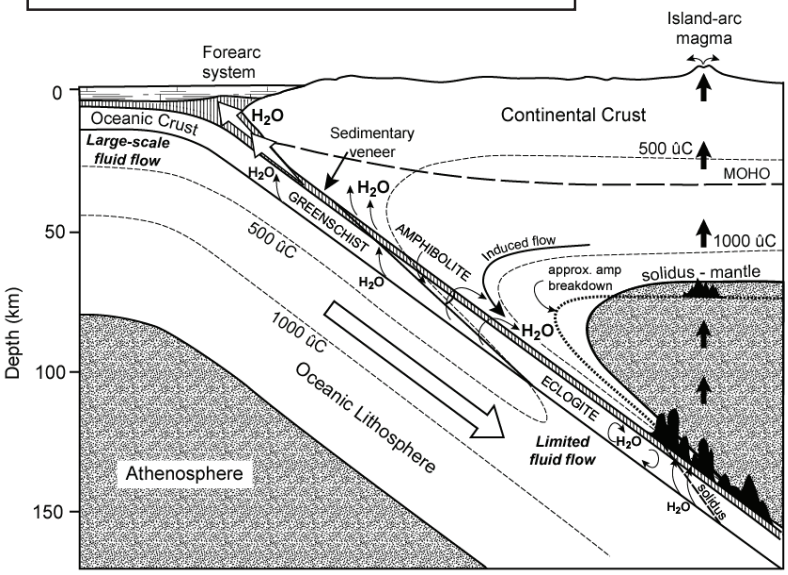
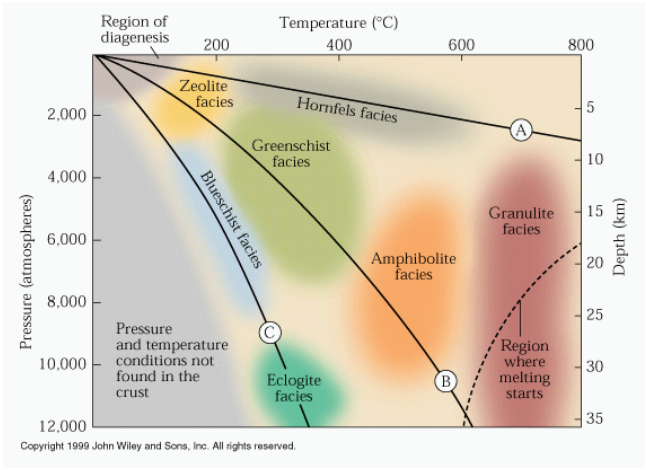
# LECTURE Twenty: Blueschists and Eclogites

**IN THIS LECTURE**
- Tectonic Environment and Geothermal Gradients
- Changes in Metamorphic Facies
- Mineralogical Characteristics
- Blueschists
- Eclogites
- Blueschist Facies Minerals

**Metamorphism of Basic Igneous Rocks and Facies Classification**
- The mineral assemblages of metabasites are less sensitive to changes in pressure and temperature than those of pelites except at very low grades
- Therefore the zones that they define represent a broader range of P-T conditions of formation
- Can be regarded as less useful than pelites
- However, metabasites are more common than true metapelites and so are more easily correlated over large areas




## BLUESCHISTS

Inferred to form under unusual physical conditions, relatively high P and relatively low T.
If pressure is supplied by loading, ie burial, then this must be a transient state or else the temperature would increase
Lead to the idea that blueschist are formed in subduction zones where such P-T conditions are possible

A necessary corollary of the above is that blueschist must also be unroofed quickly or else they would not be preserved. Hence exhumation rates are rapid

Blueschists are most common in the Phanerozoic. Very few genuine examples of blueschists older than 200Ma exist. Possible examles may be discovered.

**Typical Mineralogy**
Characteristic glaucophane, lawsonite, albite
Also may be present actinolite, chlorite, zoisite, clilnozoisite

## ECLOGITES

Essentially a rock of basaltic bulk composition composed of garnet + omphacite and/or rutile.
Density about 3.4 g/cm3 (or higher) vs basalt about 2.9 g/cm3 and amphibolite about 3 g/cm3

**Types**
Type A mostly inclusions in ultramafic rocks under high T conditions 900-1600°C
Type B associated with high-grade rocks under medium T conditions of about 550-900°C
Type C associated with blueschists under low T conditions of about 450-550°C

**Typical Mineralogy**
Garnet, omphacite, kyanite, orthopyroxene, phengite, paragonite, rutile

## MINERALOGICAL CHANGES DEFINING THE FACIES

**Changes in the composition of amphibole**
Low temperature – actinolite [Ca- amphibole]
High temperature – hornblende [K-Ca amphibole]
High pressure – glaucophane [Na-amphibole]

**Formation of pyroxene under extreme conditions**
High pressure – low temperature - Jadeite-rich clinopyroxene
High pressure – higher temperature – omphacitic clinopyroxene

**Changes in feldspar composition**
Low temperature – albite
Higher temperature – plagioclase
High pressure – albite and no plagioclase

**Formation of hydrous Ca-Al silicates**
Low grades - Zeolites, prehnite, pumpellyite
High pressure / low to med temperatures – lawsonite
Epidote stable over wide P-T region although progressively replaced by plagioclase at high temperatures
Zoisite and clinozoisite typical of relatively high-pressures and/or high temperatures

**Presence or absence of garnet**
Only present at medium to high pressures

## REACTION TEXTURES

Reaction textures in blueschists and eclogites often difficult to interpret

Relatively low temperature conditions means that recrystallisation reactions are sluggish and there is often preservation of too many mineral phases for them all to be stable

Textures of precursor igneous rock can influence the way in which metamorphic minerals develop

Complex zoning because of variations in chemical composition of different minerals

Blueschists and eclogites can often co-exist because of differences in bulk composition that often result from sea-floor alteration processes