

Rocks

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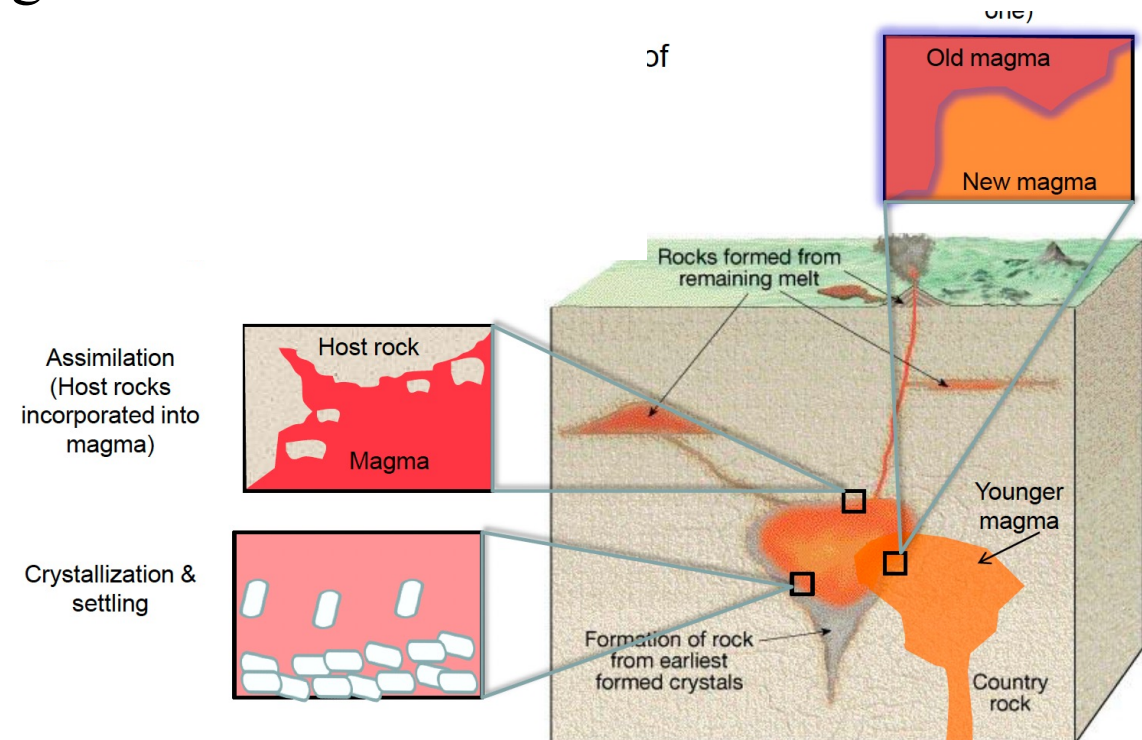
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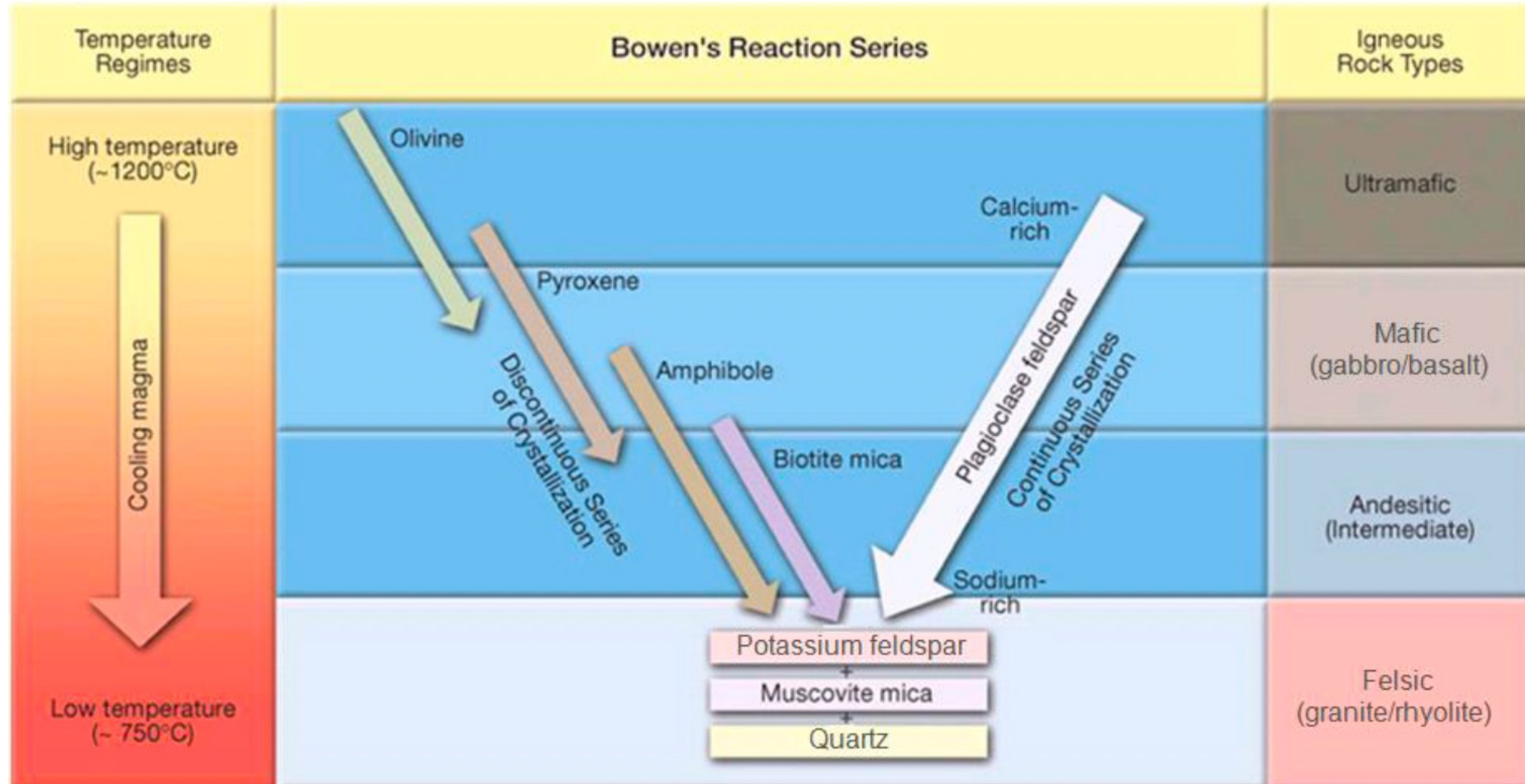
Igneous Rocks: magma to varied rock types

Magma does not freeze at one particular temperature, rather over a range. With progressive cooling different minerals form at different temperatures. **Fractional Crystallization** is a process by which the crystals formed in a cooling magma are segregated from the remaining liquid rock. Result. → composition of the melt continually changing. **Magmatic Differentiation**: a process by which rocks of varying composition can arise from a uniform parent magma.

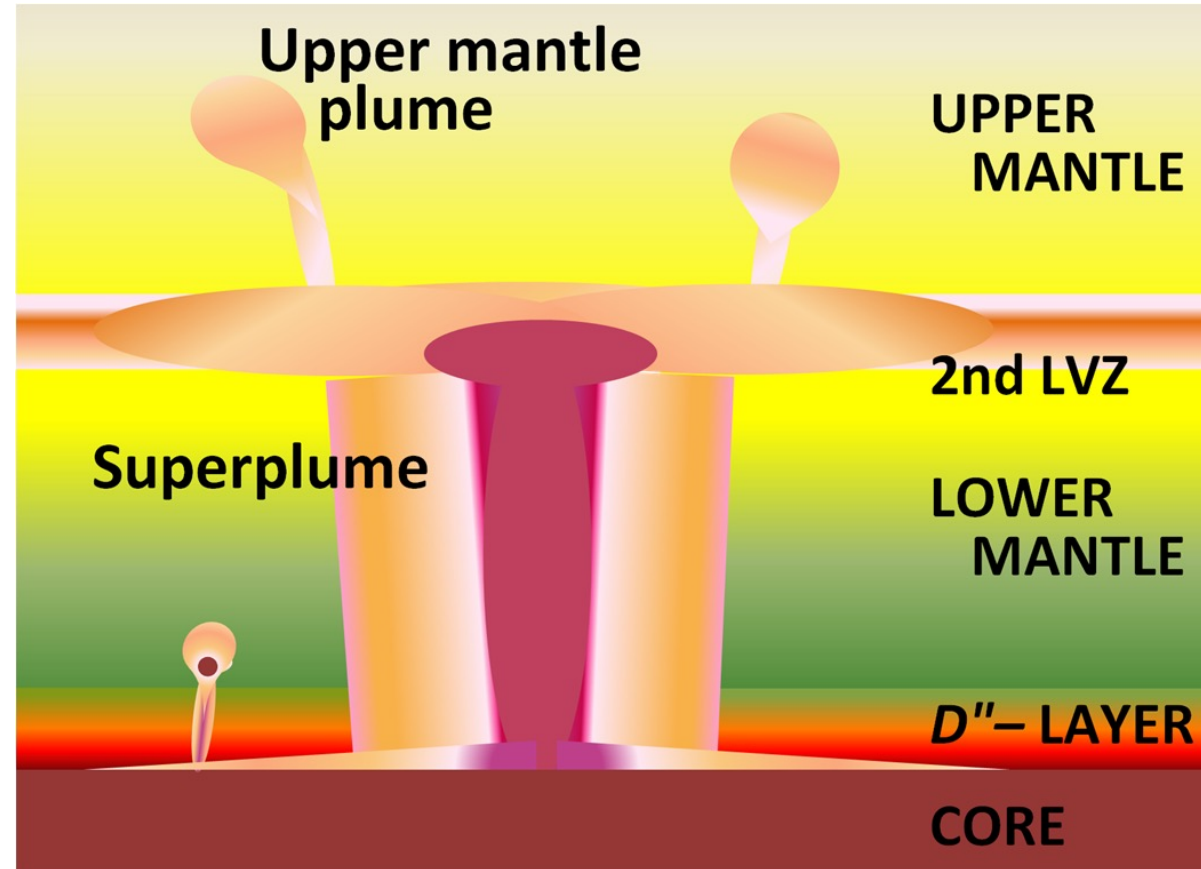
Bowen's reaction series explains the formation sequence of different minerals.



Igneous Rocks: Bowen Series



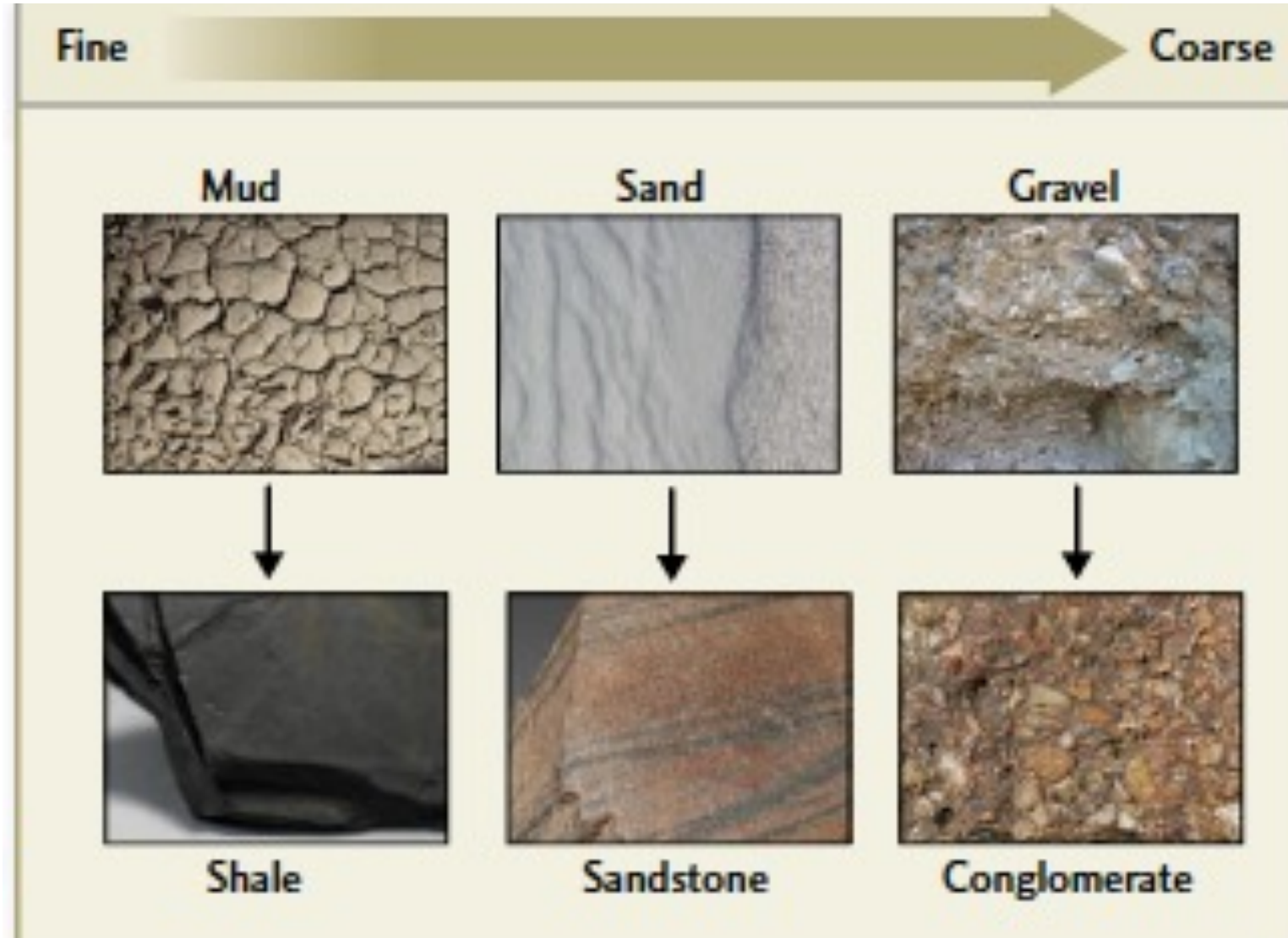
Igneous processes and plate tectonics



Mantle plume is a buoyant mass of material in the Earth's mantle that rises due to its buoyancy

Mantle plumes forming within lithospheric plates rather than along the margins of plates.

Sediments to Sedimentary Rocks



Metamorphic Rocks

Result of a process – **Metamorphism** – by which rocks undergo **solid-state changes** in mineralogy, texture, or both to reach **equilibrium** with changing environment

Metasomatism : Metamorphism in open system when chemical composition also changes

Agents of Metamorphism

Mineralogy
Texture
Chemical
composition

Three main agents/causes:

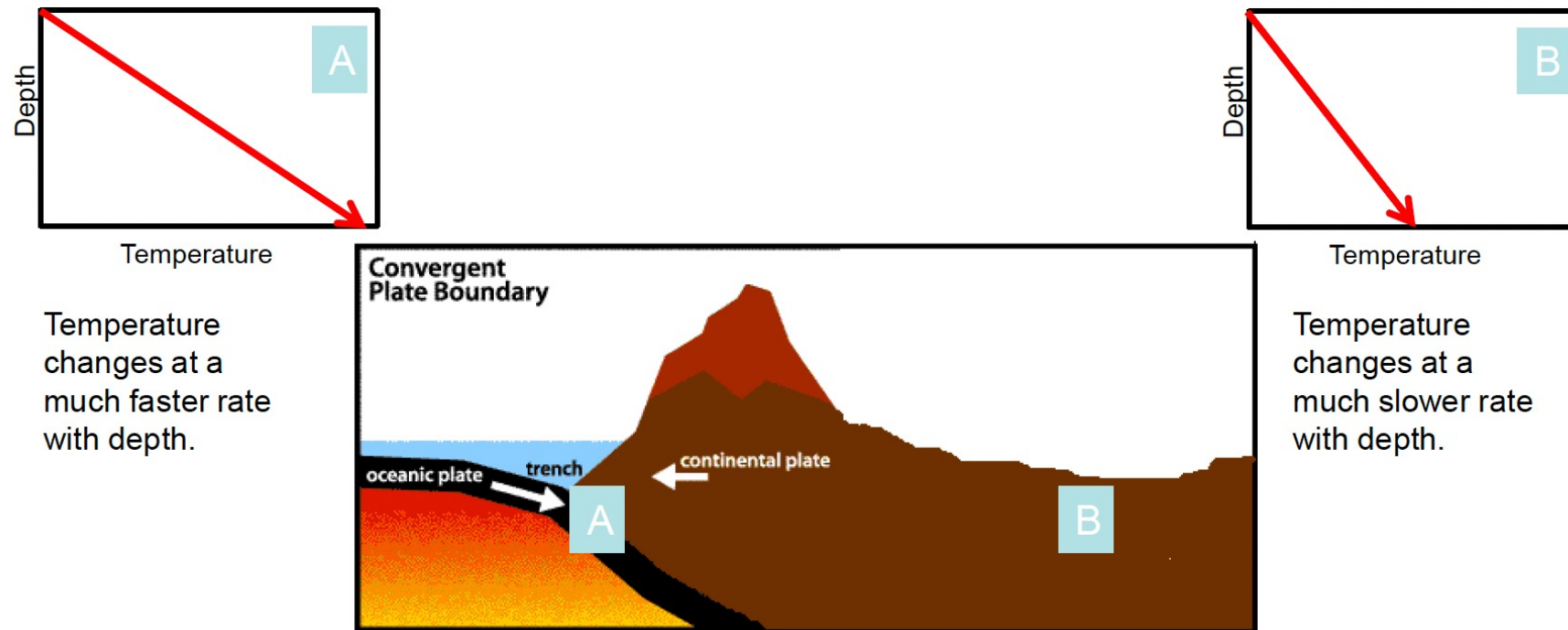
1-2. **Heat and Pressure:** for crystallization of new minerals, recrystallization of earlier minerals to **larger size**

3. **Chemically active fluids (chemical composition will change):** CO_2 , SO_2

The proportion of influence of the agent varies between types of metamorphism.

Temperature as an agent

Sources: Earth's **internal heat** (primordial heat generated during the formation and heat from radioactive decay)



Geothermal gradient: generally on average it is about 30C/Km

Pressure as an agent

Confining pressure [non-directional]: force equal in all directions. When a rock **descends** into greater depths is subjected to progressively increasing confining pressure, proportional to the weight of the overlying mass.

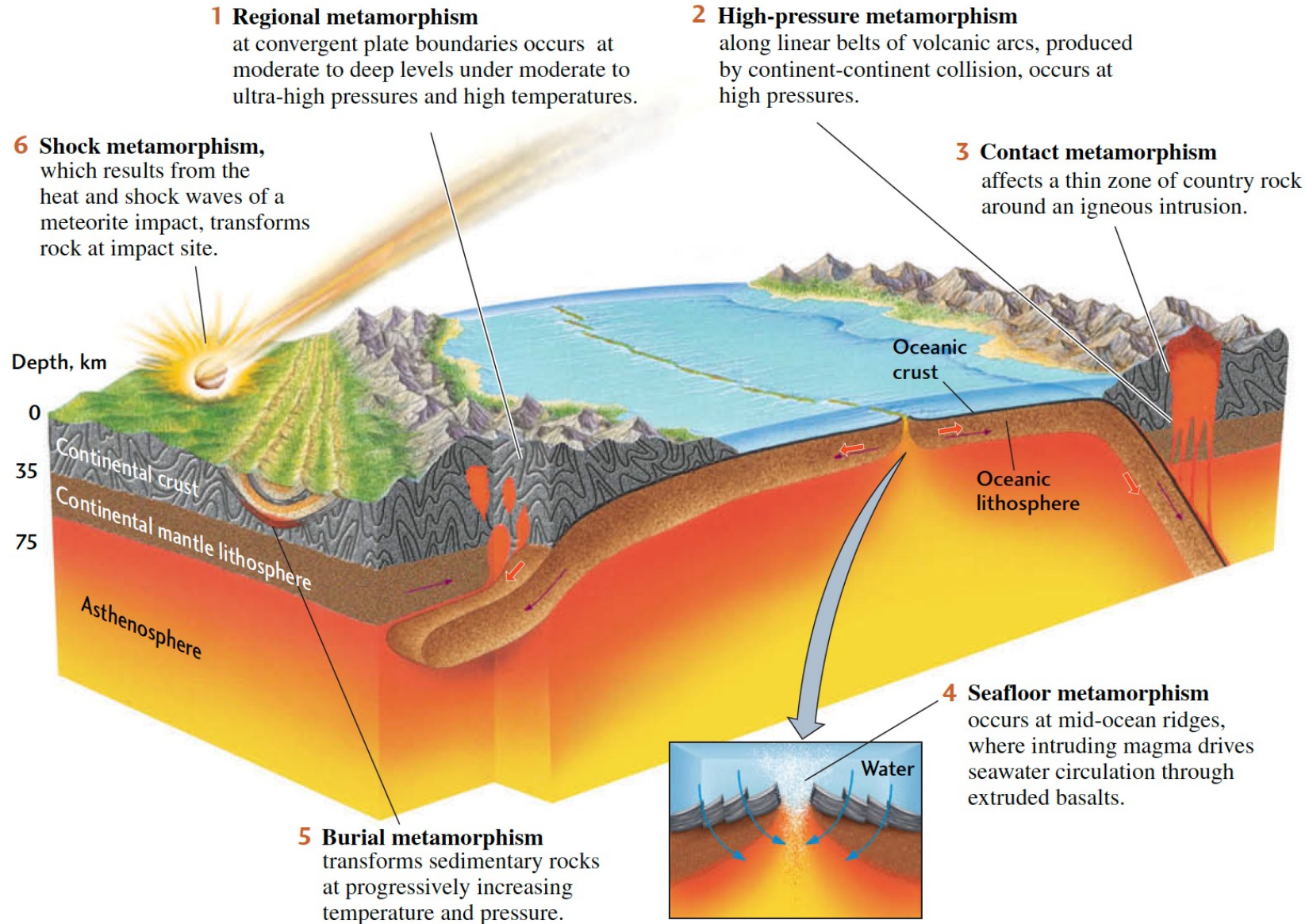
Directed/Differential pressure: force exerted in a particular direction. This pressure is usually along discrete planes.

Contact Metamorphism

Rocks immediately surrounding a molten igneous body are “baked”, mainly due to heat.

No deformation

Types of Metamorphism



Metamorphic grade: textural variation

and coarseness of foliation.

Increasing intensity of metamorphism

Low grade

Intermediate grade

High grade

Slate



Phyllite



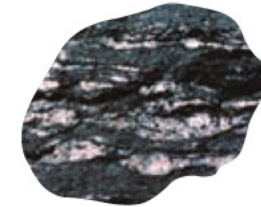
Schist (abundant platy minerals)



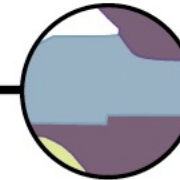
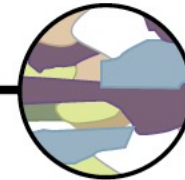
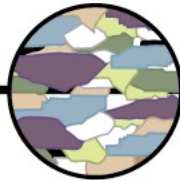
Gneiss (fewer platy minerals)



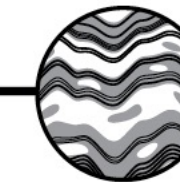
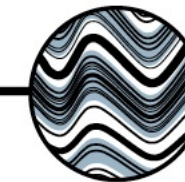
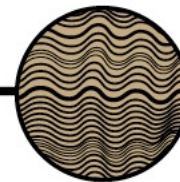
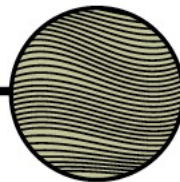
Migmatite



Increasing crystal size



Increasing coarseness of foliation



Slaty cleavage

Slaty cleavage

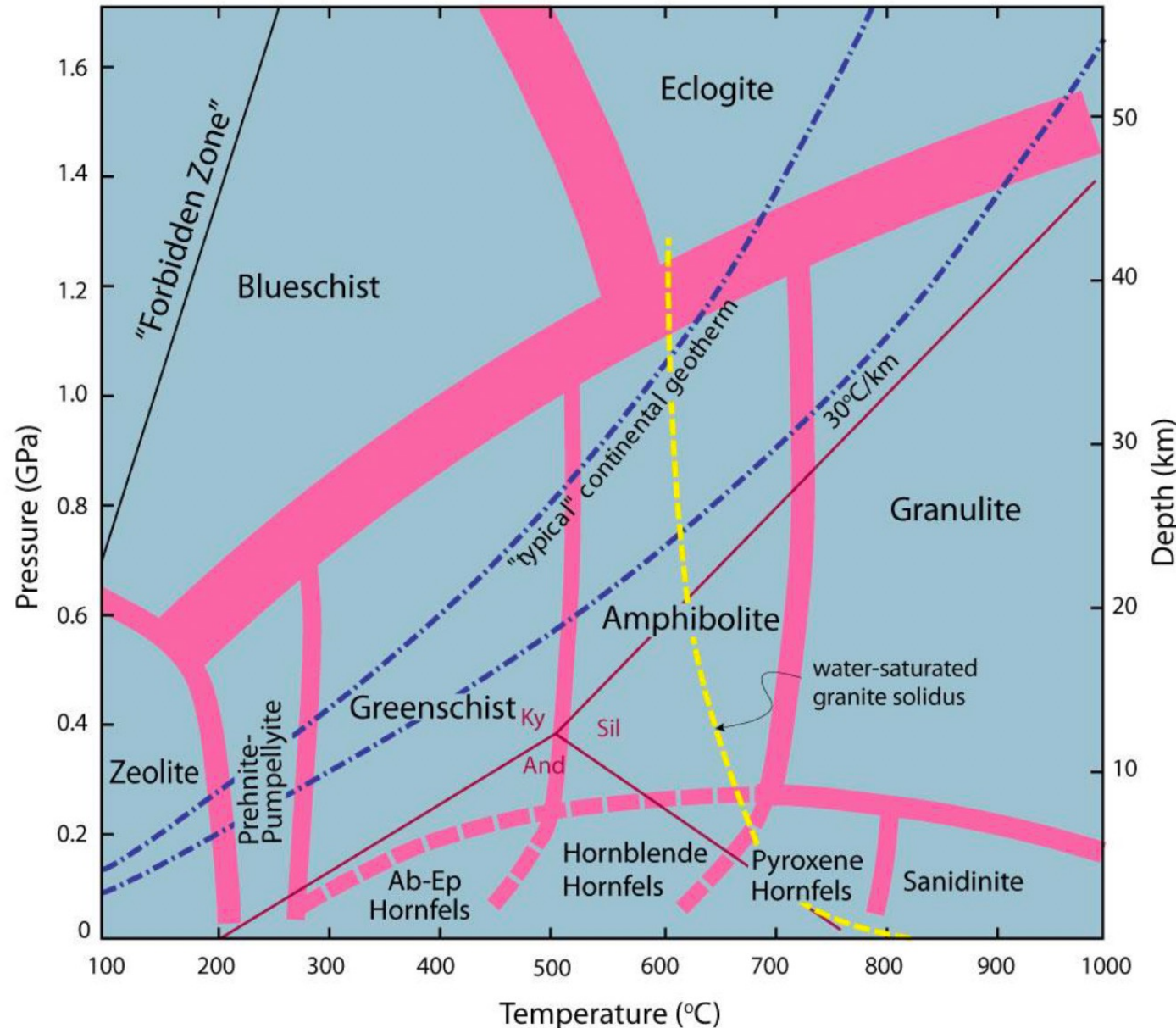
Schistosity

Banding

Banding

Shale

Metamorphic facies [3rd year]



Metamorphic facies: Based on association of minerals in rocks as function of composition