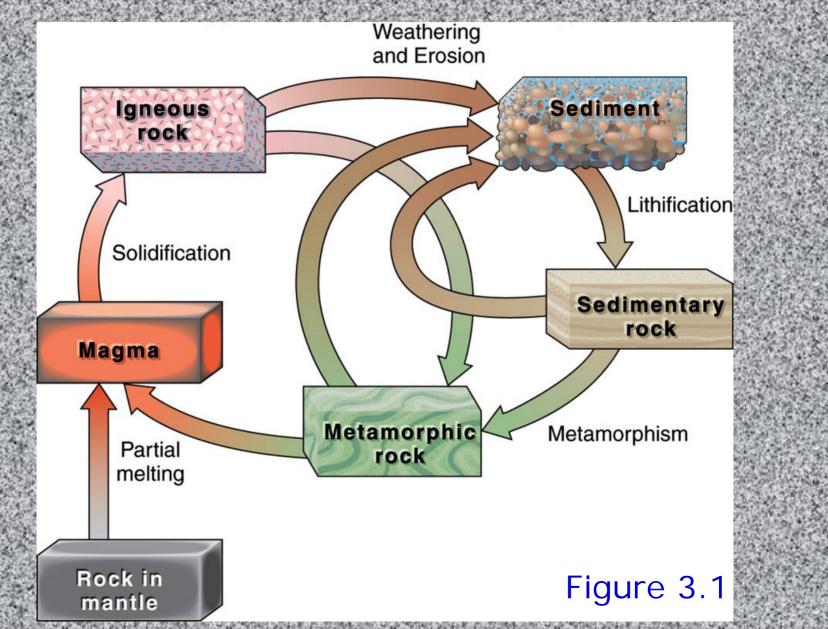
The Rock Cycle



Igneous rocks

Formed by cooling and solidifying magma

Magma – molten rock

Lava – magma on the Earth surface

Magma and igneous rocks can be:

Extrusive - on the Earth surface

Intrusive – magma solidifies underground

Rock cycle – plate tectonic example

Sediment transported to deep ocean floor

Sedimentary rock

Sediment transported into basin

Sedimentary metamorphic

Partial melting of metamorphic rock

Sedimentary rock metamorphosed in subduction zone

Hot mantle rock partially melts to form magma Figure 3.2

Textures of igneous rocks

Coarse grained – mineral grains greater than 1 mm, can see with the eye

Magma cools slowly, enough time to form large crystals

Intrusive rocks are very good insulators

Textures of igneous rocks

Fine grained – mineral grains smaller than 1 mm

Magma cools quickly

Glass forms when quenched quickly, such as lava flowing into water

Extrusive

Intrusive granite – coarse texture

Quartz gray Plagioclase white

Figure 3.5

K feldspar is stained yellow

Intrusive granite – thin section

Note interlocking mineral grains Figure 3.1

1mm



Mafic

Intermediate

Silicic

Gabbro

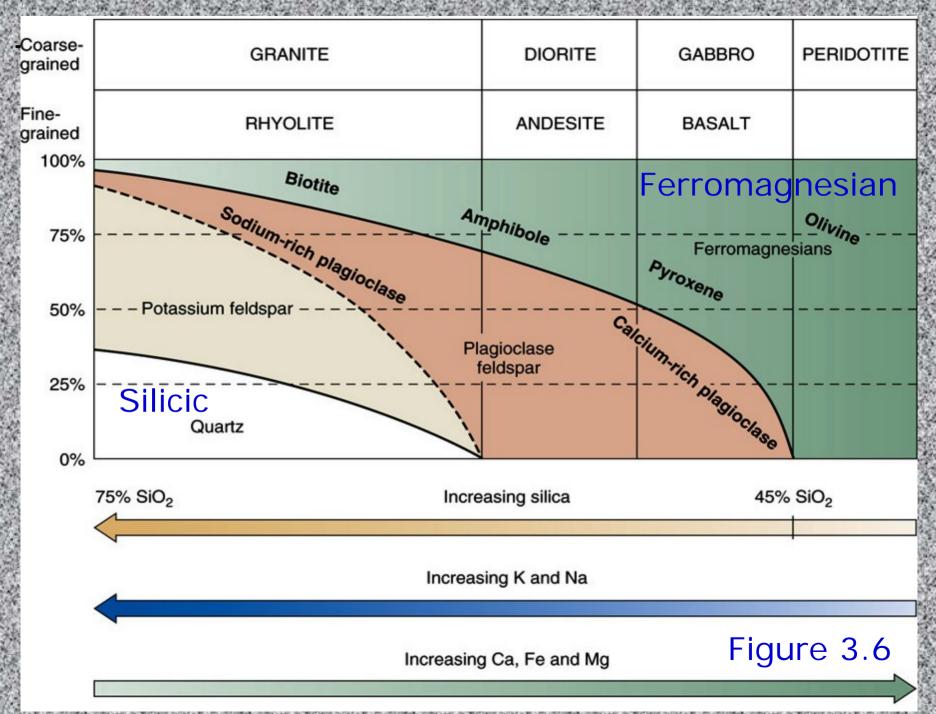
Diorite

Granite

Basalt

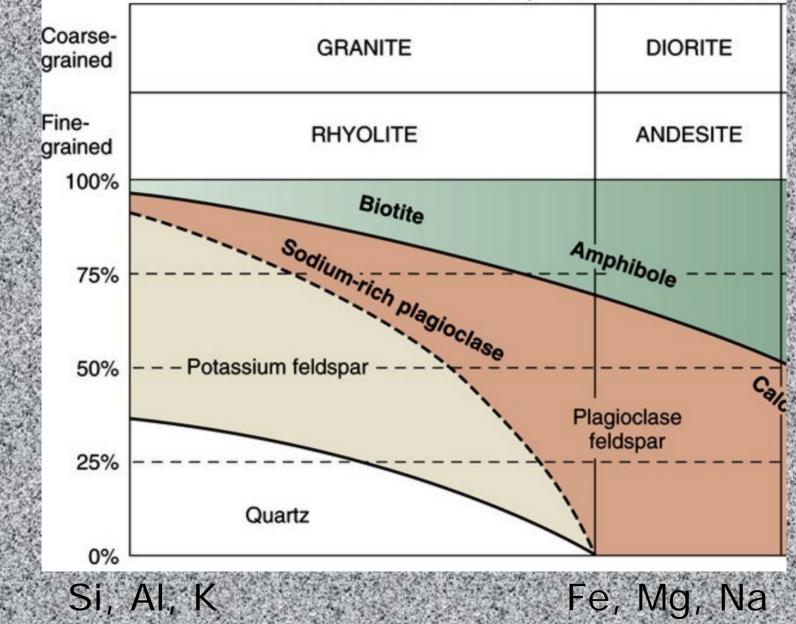
Andesite

Rhyolite



注意是这些教育的人名"你们"你们说,我们是你们的你的教育的人名"你们"你们说,我们是你们的你们的你们,我们是你们的你们,我们们就是你们的,我们是你们的你们,我们们不能能是我们的你们,我们们能能能能能。

Granite and diorite

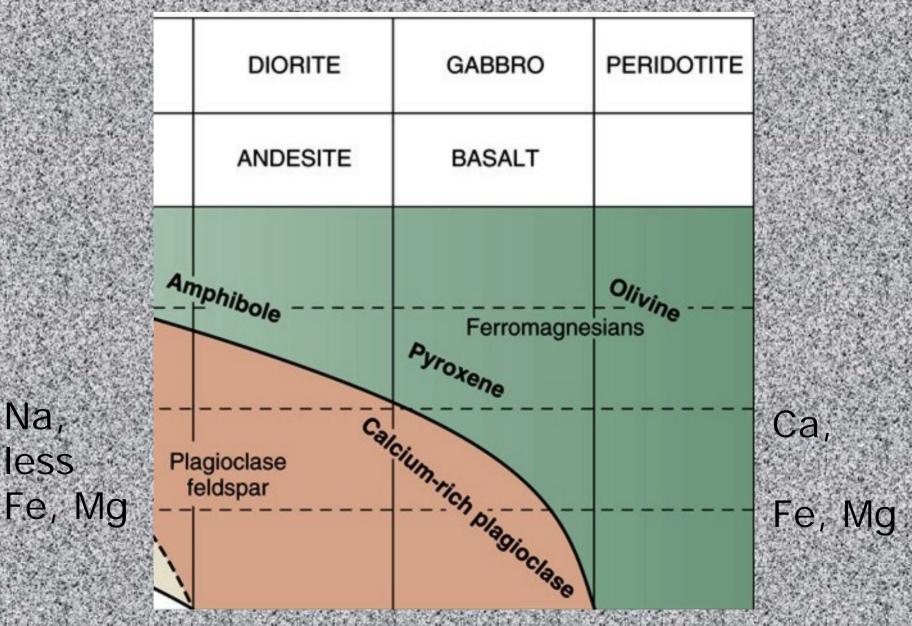


Granite and diorite

Granite

Diorite

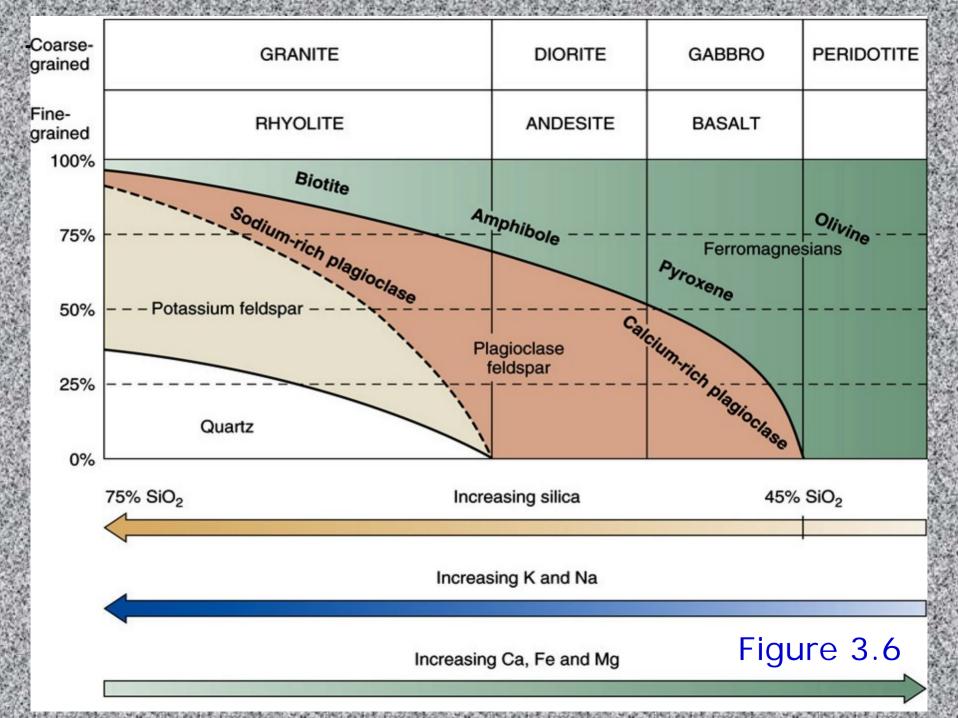
Diorite and gabbro



Diorite and gabbro

Diorite

Gabbro



Intrusive (granite) vs. extrusive (rhyolite)

Rhyolite

Granite

Intrusive (diorite) vs. extrusive (andesite)

Diorite

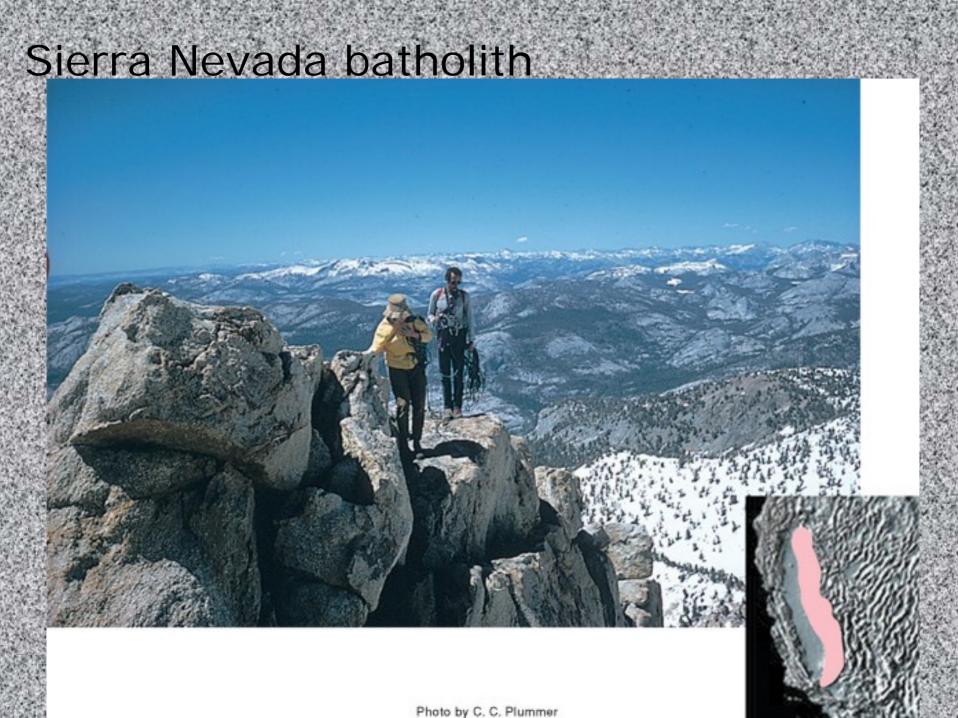
Andesite porphyritic

Intrusive (gabbro) vs. extrusive (basalt)

Gabbro

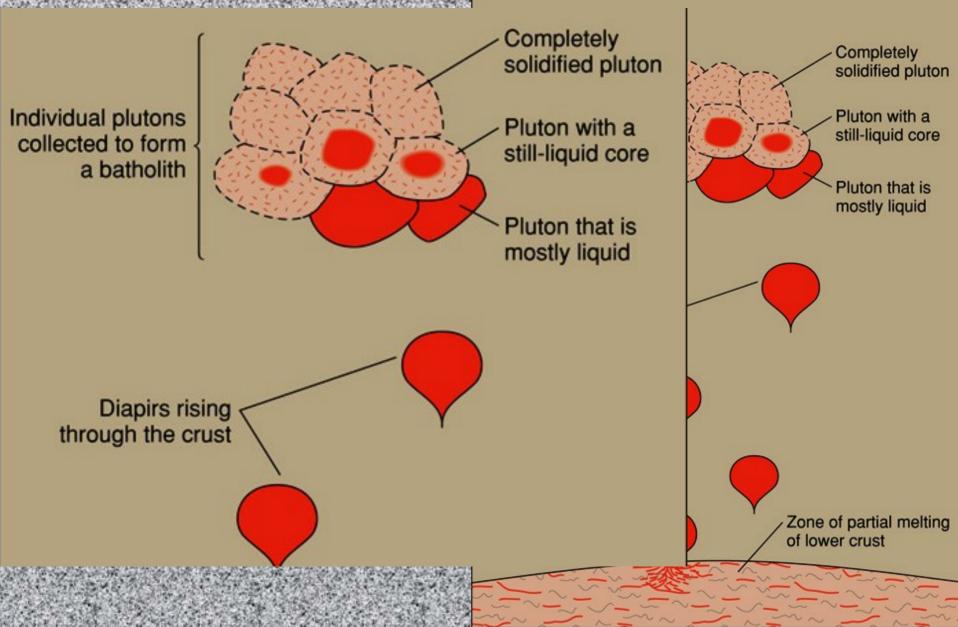
mhuunin

Basalt



Forming a batholith

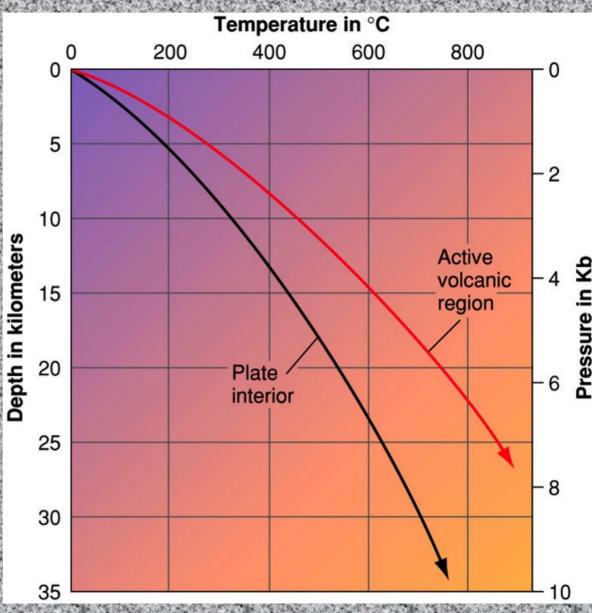
Mountains at the earth's surface



How magma forms

The geothermal gradient

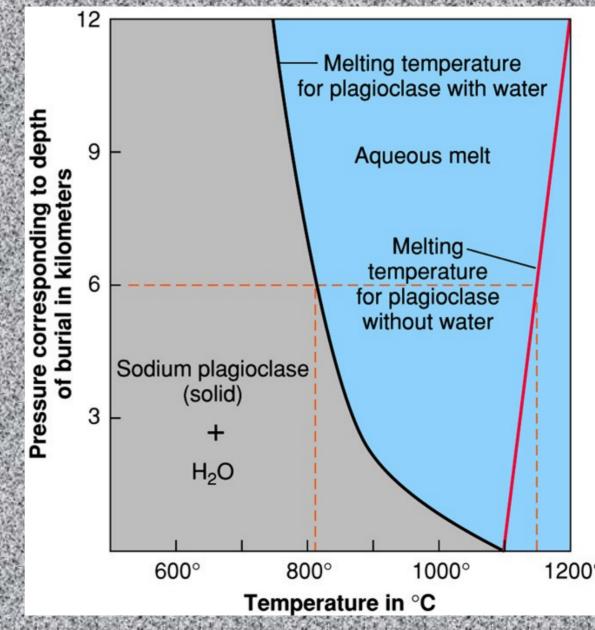
about 3^o C in 100 m



Factors that control melting temperatures

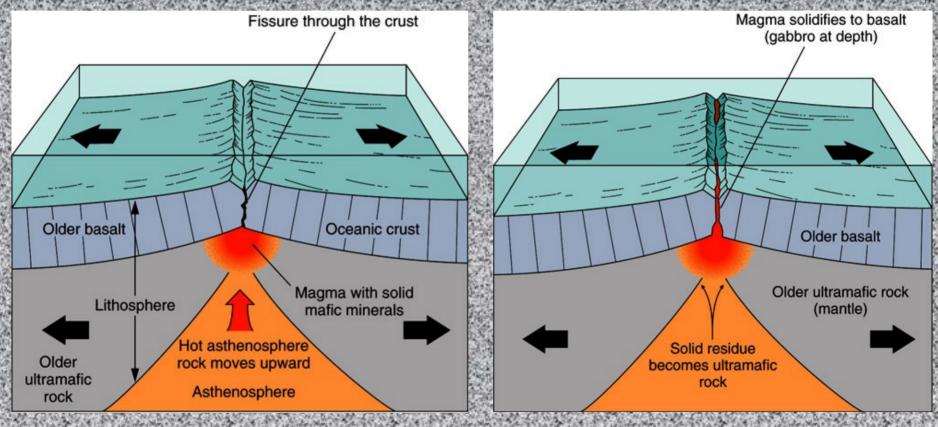


Water



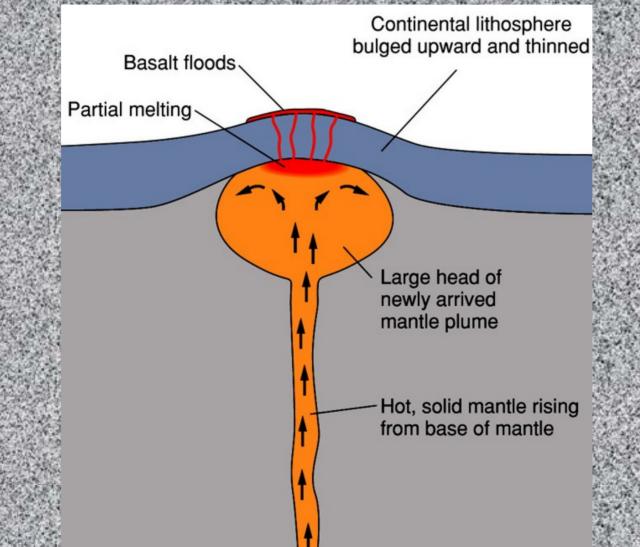
Igneous activity & plate tectonics

Divergent boundaries – seafloor spreading

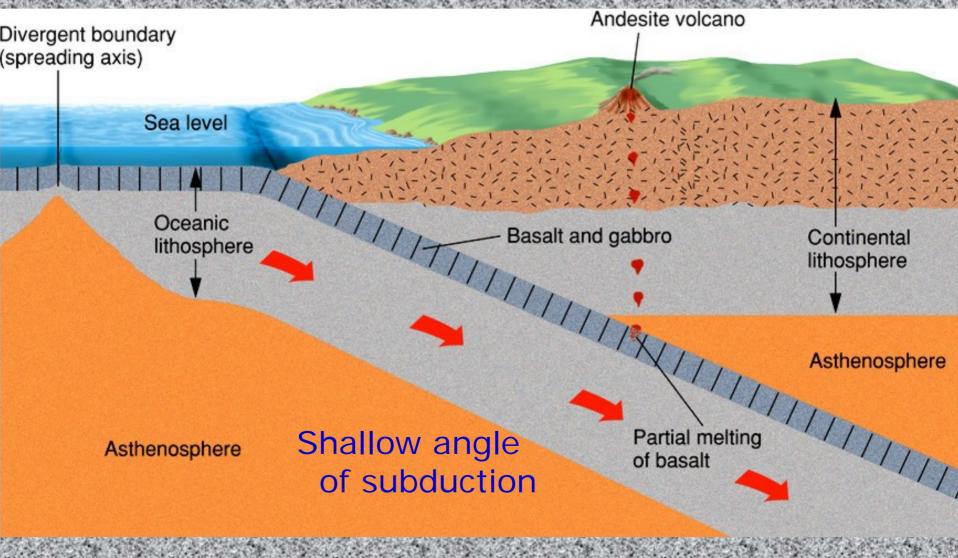


Igneous activity & plate tectonics

Mantle plume under continental crust

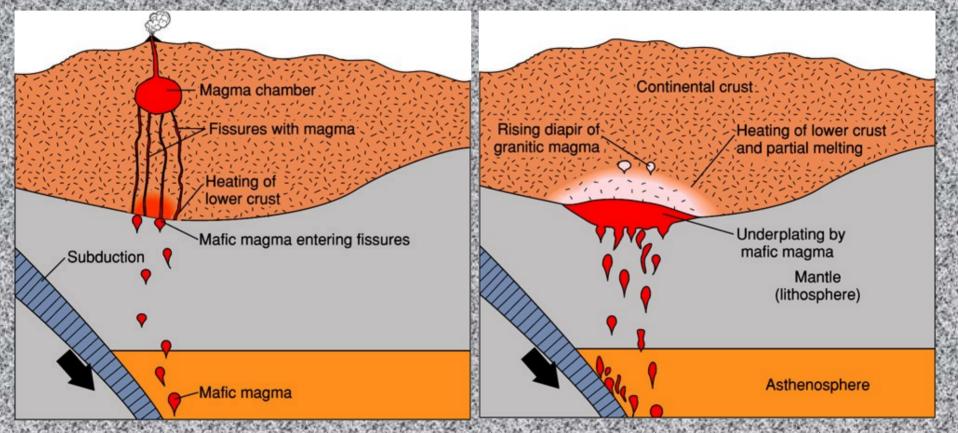


Igneous processes at convergent margins Washington-Oregon coast Juan de Fuca Ridge offshore



Igneous processes at convergent margins Sea level Oceanic crust Continental crust Mixing of magma Sedimentary rocks Granitic plutons emplaced Felsic magma Intermediate magma Bas Oceanic Mantle lithosphere ("rigid") 800°C Zone where wet mantle Asther Kilometers partially melts (m 100 Water from subducting crust

Two modes of forming magma Many batholiths are mostly granite, not diorite



Intermediate magma produces diorite

Heating of crust produces granite

Diorite batholith Antarctica

Granite batholith, Chile

End