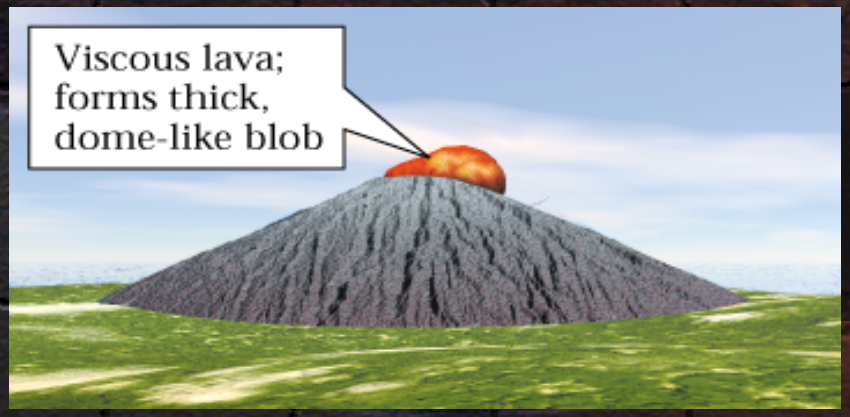
The 2 Main Factors controlling Viscosity

SiO_2 MAKES LAVA MORE VISCOUS

HIGHER TEMPERATURE DECREASES VISCOSITY



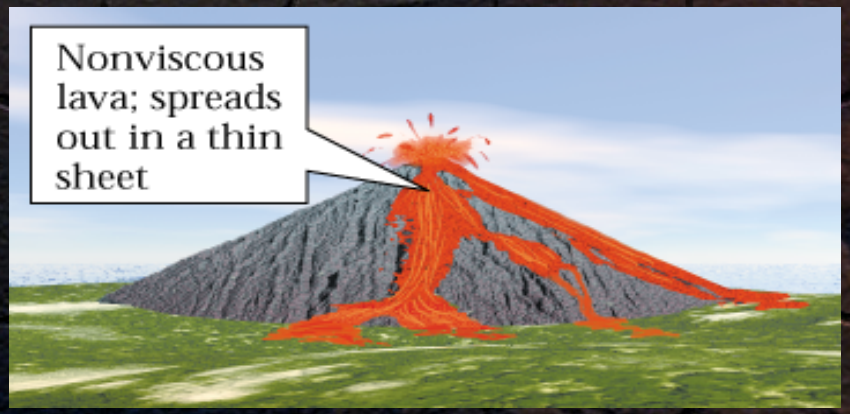


Image: S. Marshak "Earth, Portrait of a Planet"

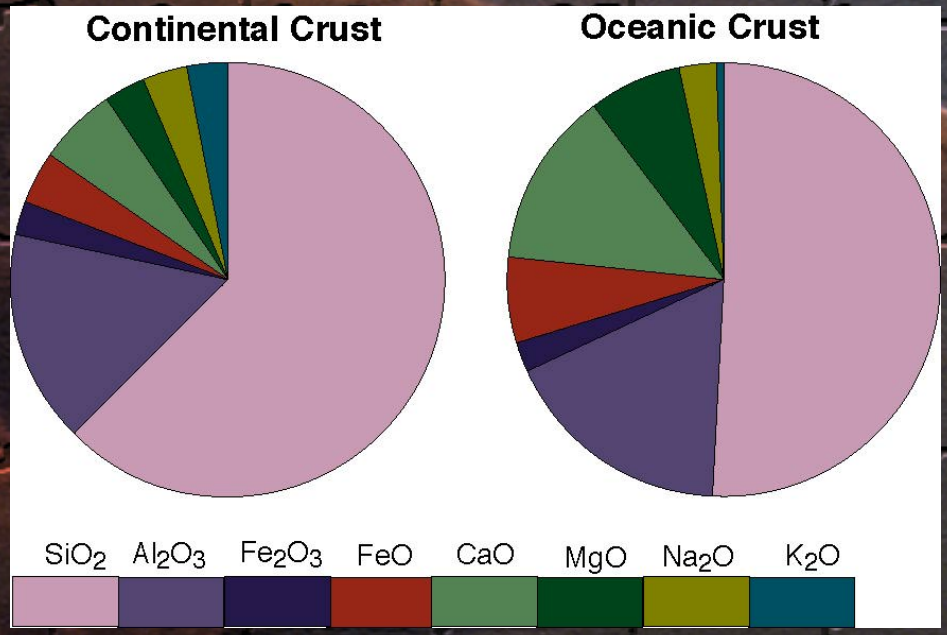
MORE VISCOUS
- high-SiO_2 (Quartz)
- cold

LESS VISCOUS
- low-SiO_2 (Olivine)
- hot

SiO_2 = silica

Crustal Rock Properties

- crustal thickness
- composition (SiO_2 content)



CONTINENTAL CRUST HAS MORE SiO_2 THAN OCEANIC CRUST

SiO_2: silica

Factors Controlling the Type of Volcanism

Crustal/Rock Properties

OCEANIC CRUST
- thin
- dense, dark rock

CONTINENTAL CRUST
- thick
- less dense, light rock

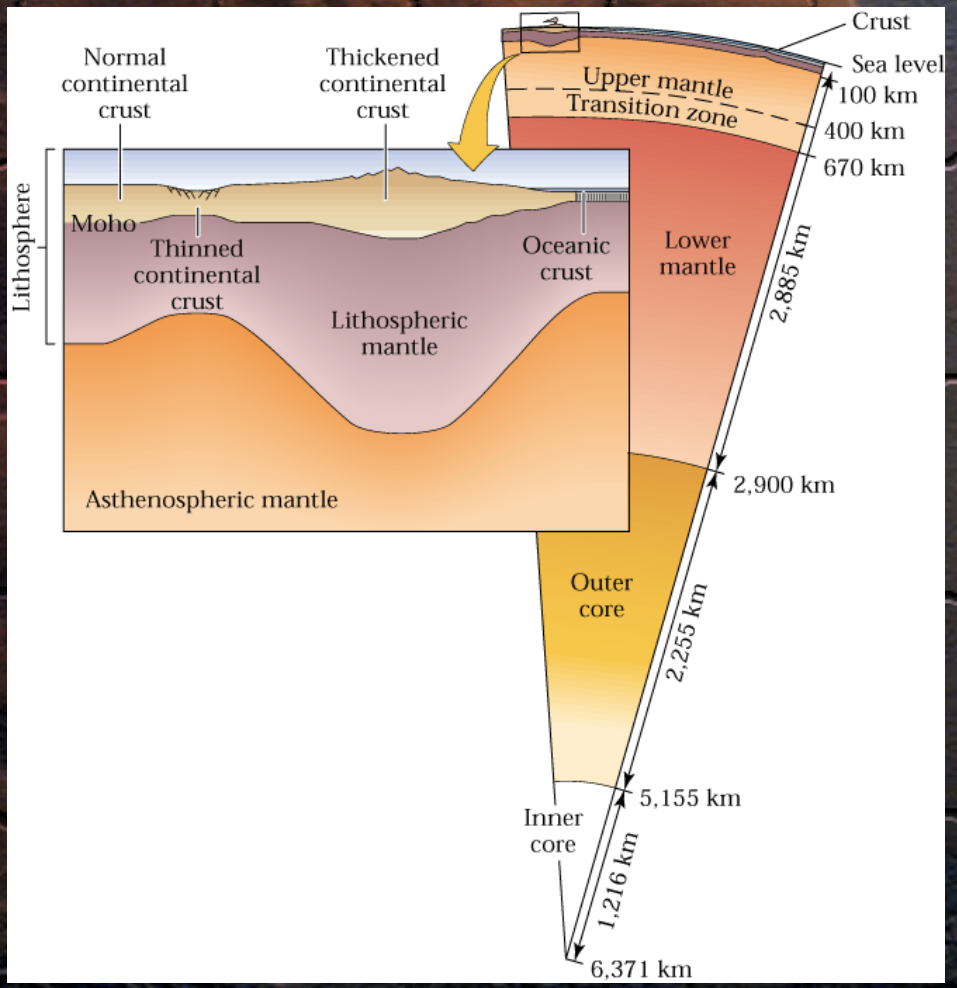


Image: S. Marshak "Earth, Portrait of a Planet"

Rock Classification (by SiO_2 Content/Realm)

		Volcanic/Plutonic Rock
silicic (or felsic or rhyolitic)	65-70%	Rhyolite/Granite
intermediate (or andesitic)	55-65%	Andesite/Diorite
mafic	40- 55%; rich in Mg, Fe	Basalt/Gabbro

light color

dark color

Rock Classification (by SiO_2 Content/Realm)

Granite: plutonic (coarse grained)
silicic (light-colored)

Basalt: volcanic (fine-grained)
mafic (dark-colored)

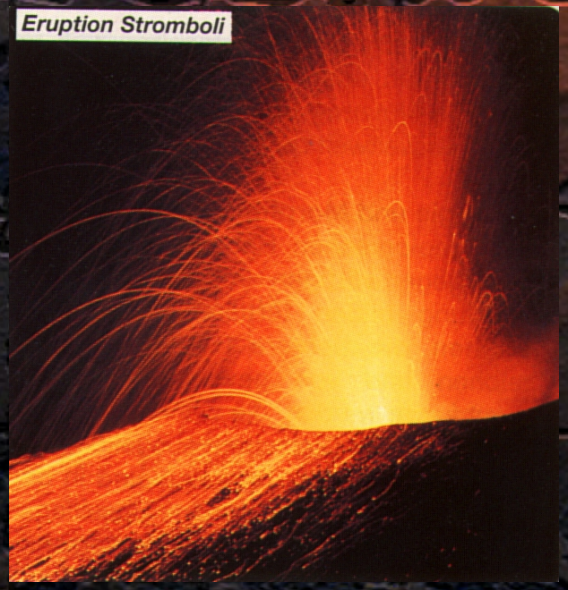
Rocks and Minerals

Melting T depends on composition: Granite 650°C, Gabbro 1100°C

- **rock consists of many minerals**
- **melting T of SiO_2-rich minerals (e.g. Quartz) 650°C**
- **melting T of SiO_2-poor minerals (e.g. Olivine) 1100°C**

Magma/Lava Composition

- molten rock
+ dissolved grains
+ dissolved volatiles
  up to 15%
  (50% H_2O, 20% CO_2, SO_2, H_2S, others)



Magma and Lava

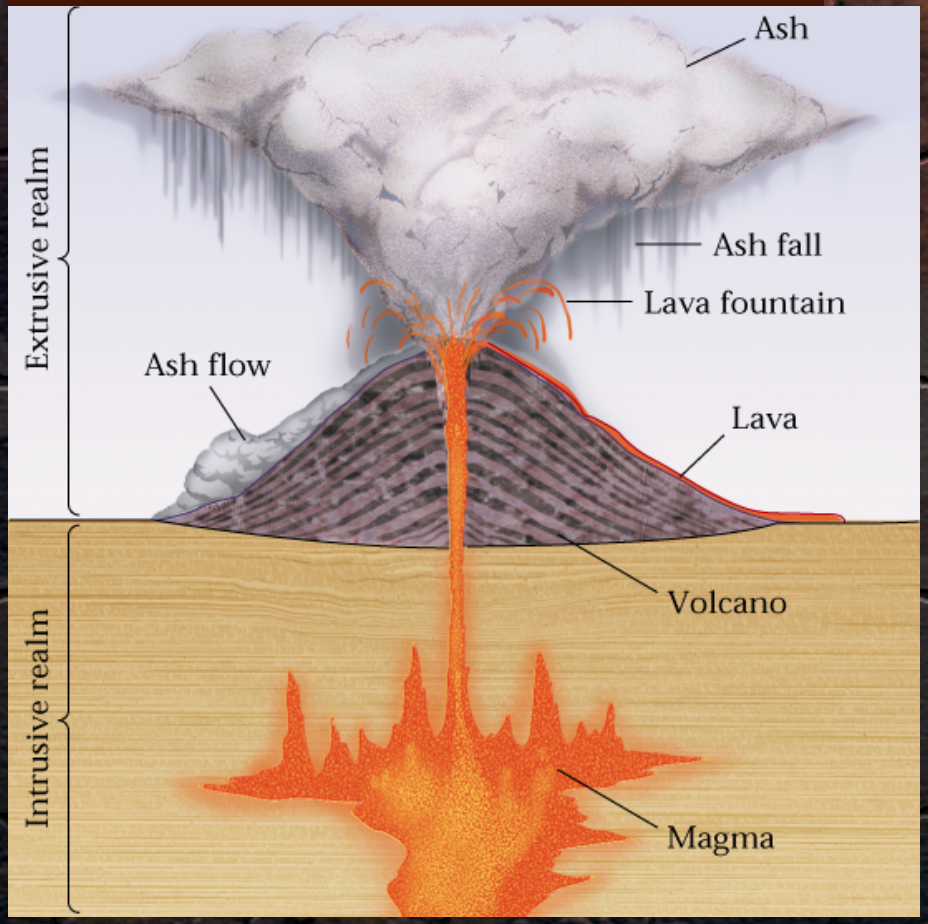
melting T or freezing point: 650 - 1100°C

Quartz: 650°C
Olivine: 1100°C

y°F = x°C*9/5+32
1200 - 2000°F

oven T: 260°C/500°F

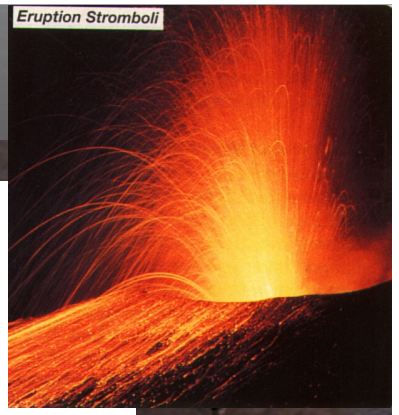
Image: S. Marshak "Earth, Portrait of a Planet"



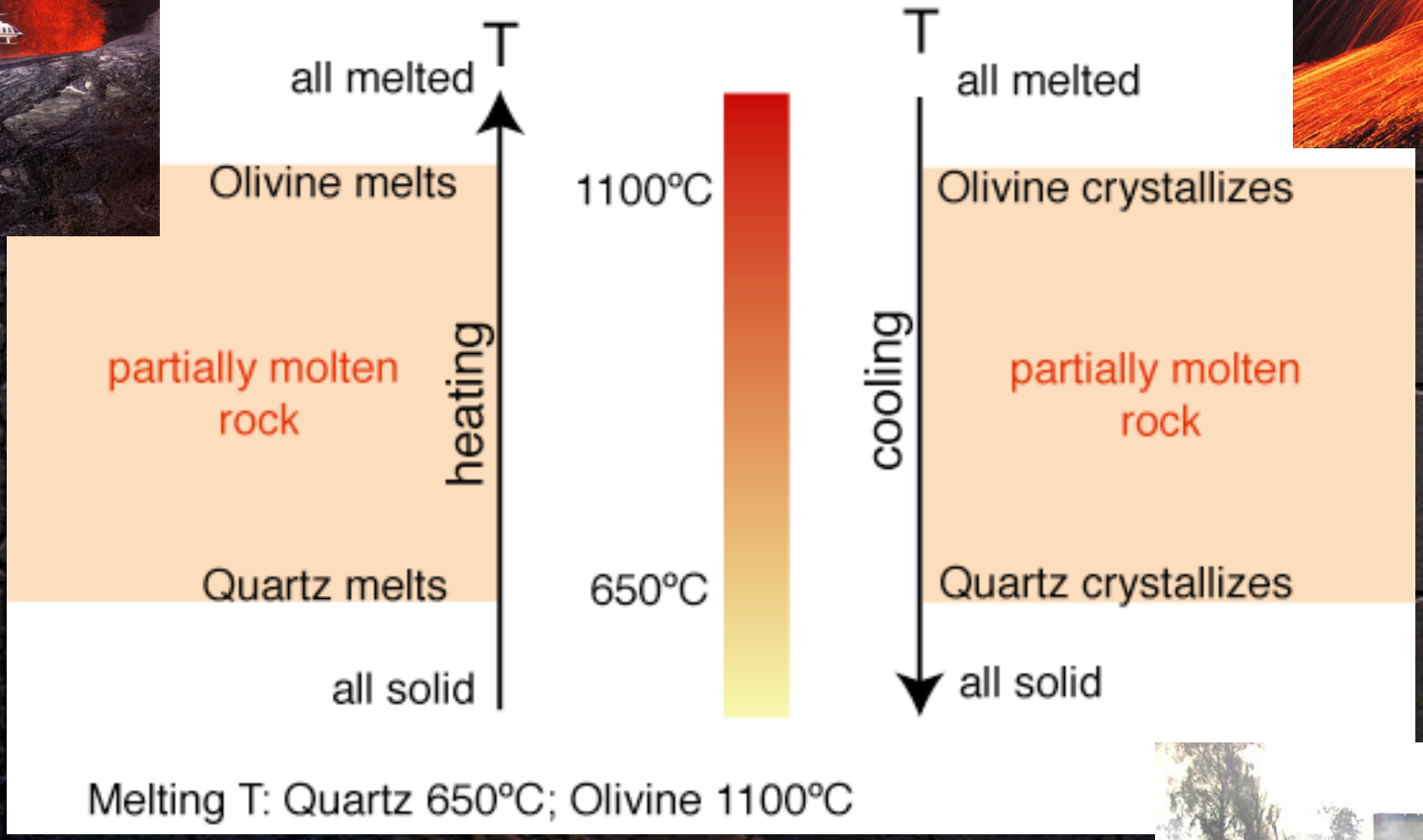
LAVA
- surface
- volcanic
- extrusive

MAGMA
- underground
- plutonic
- intrusive

Rocks and Minerals



Melting and Freezing of Rock Minerals



Melting T: Quartz 650°C; Olivine 1100°C

- **melting solid rock: Quartz earliest to melt**
- **solidifying hot melt: Quartz latest to crystallize**

-> lava has more SIO_2 than mantle rock left behind