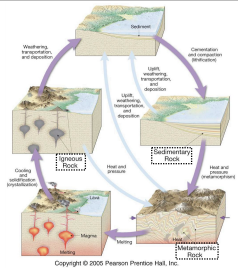


Any Questions?

1

The Rock Cycle

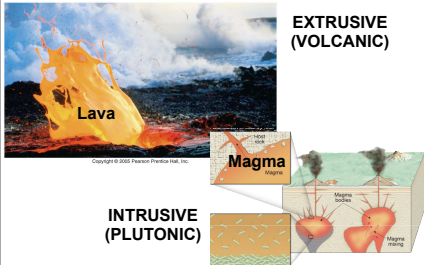


2



3

Igneous Rocks

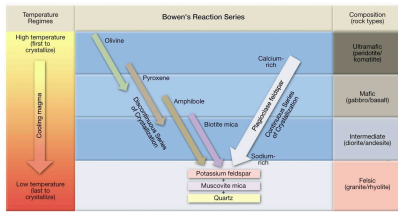


4

Igneous Rock Names are based on..

5

Bowen's Reaction Series



Shows which minerals crystallize at particular temperatures, NOT anything about cooling time.

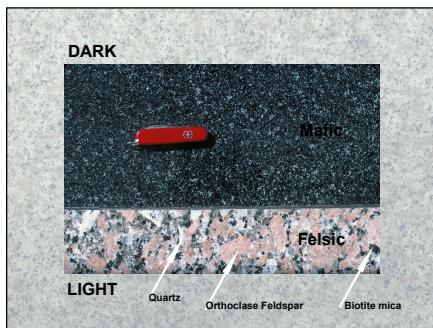
6

Igneous Rocks - Mineralogy



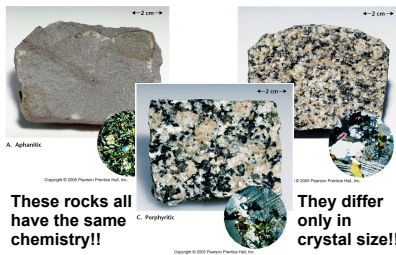
- **MAFIC** - rocks that are rich in ferromagnesian minerals (Fe, Mg)
- **FELSIC** - rocks that are rich in silicon and aluminum minerals (Si, Al)

7



8

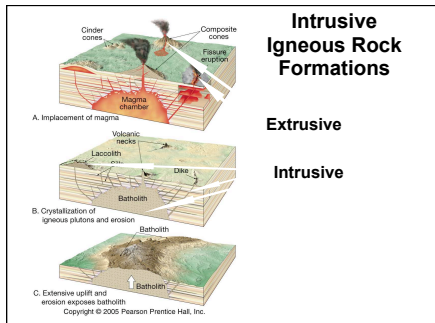
Cooling & XL Size



9

Intrusive Igneous Rock Formations

10



11

Intrusive Rock Bodies

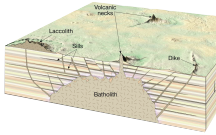
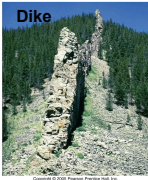
| | Tabular (table-like) | Massive (about as thick as wide) |
|---|-------------------------|--|
| Discordant (cuts across strata) | Dike | Batholith |
| Concordant (parallel with strata) | Sill | Laccolith |

12

Dikes and Sills

All tabular

Sills = concordant
Dikes = discordant

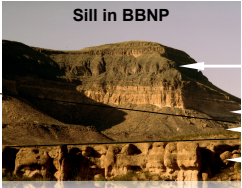


13

In Texas



Sill in BBNP



Sill

Sedimentary rock
Sill
Sedimentary rock

BBNP = Big Bend National Park

14

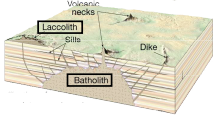
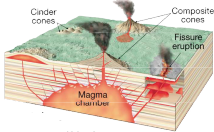
Batholiths and Laccoliths

All massive

Laccoliths=concordant
Batholiths=discordant

Laccoliths actually cause the sediments above them to arch up giving them a mushroom appearance.

Batholiths are usually > 100 km² in size. They form the cores of many mountains on the US west coast.



15



Batholiths of the Western US

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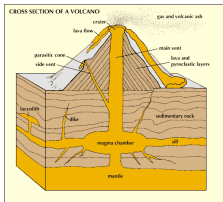
16

Extrusive Igneous Rocks

Extrusive igneous rocks cool very quickly so they usually have small mineral crystals

17

Lava is merely magma that has made it to the surface. It comes from magma chambers in the subsurface.



18

Mafic Lavas

Mafic lavas have low viscosity and, therefore, are very fluid! They may flow like water and cause relatively little widespread damage.



19

Felsic Lavas

Felsic lavas are thick and viscous and explode into hot glassy ash rather than 'flowing'.



20

| Chemical Composition | Granitic (Felsic) | Andesitic (Intermediate) | Basaltic (Mafic) | Ultramafic |
|--|---------------------------|--------------------------|------------------|-------------|
| Dominant Minerals | | | | |
| Accessory Minerals | | | | |
| TEXTURE | Phanitic (coarse-grained) | | | |
| | Aphanitic (fine-grained) | | | |
| | Porphyritic | | | |
| | Glassy | | | |
| | Pyroclastic (fragmental) | | | |
| Rock Color (based on % of dark minerals) | 0% to 25% | 25% to 45% | 45% to 85% | 85% to 100% |

21

Extrusive Igneous Rocks

| Chemical Composition | Granitic (Felsic) | Andesitic (Intermediate) | Basaltic (Mafic) | Ultramafic | |
|--|--|--|---|-----------------------------------|------------------|
| Dominant Minerals | Quartz Potassium feldspar Sodium-rich plagioclase feldspar | Amphibole Sodium- and iron-rich plagioclase feldspar | Pyroxene Calcium-rich plagioclase feldspar | Olivine Pyroxene | |
| Accessory Minerals | Amphibole Muscovite Biotite | Pyroxene Biotite | Amphibole Olivine | Calcium-rich plagioclase feldspar | |
| TEXTURE | Phanitic (coarse-grained) | Granite | Diorite | Gabbro | Pandolite |
| | Aphanitic (fine-grained) | | | | Komatiite (rare) |
| | Porphyritic | "Porphyritic" precedes any of the above names whenever there are appreciable phenocrysts | | | |
| | Glassy | | | | Uncommon |
| | Pyroclastic (fragmental) | | Tuff (fragments less than 2 mm) Volcanic Breccia (fragments greater than 2 mm) | | |
| Rock Color (based on % of dark minerals) | 0% to 25% | 25% to 45% | 45% to 85% | 85% to 100% | |

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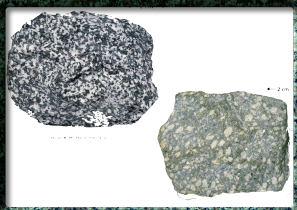


23



24

Andesite



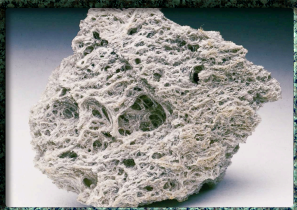
25

Rhyolite



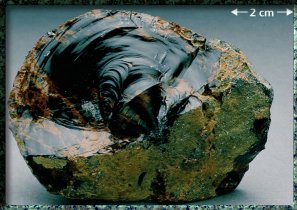
26

Pumice



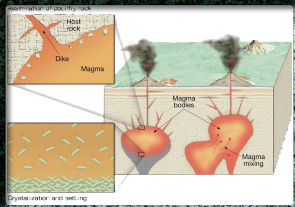
27

Obsidian



28

Mixing & Porphyries



29

Intrusive Igneous Rocks

30

| Chemical Composition | Granitic (Felsic) | Andesitic (Intermediate) | Basaltic (Mafic) | Ultramafic |
|--|--|--|---|--|
| Dominant Minerals | Quartz Potassium feldspar Sodium-rich plagioclase feldspar | Amphibole Sodium- and calcium-rich plagioclase feldspar | Pyroxene Calcium-rich plagioclase feldspar | Olivine Pyroxene |
| Accessory Minerals | Biotite Muscovite Biotite | Pyroxene Biotite | Amphibole Olivine | Calcium-rich plagioclase feldspar Pseudotachylite |
| Phenitic (coarse-grained) | | Diorite | | Panidiolite |
| Aphanitic (fine-grained) | Rhyolite | Andesite | Basalt | Komatiite (rare) |
| Porphyritic | "Porphyritic" precedes any of the above names whenever there are appreciable phenocrysts | | | |
| Glassy | Obsidian (compact glass) Pumice (frothy glass) | | | |
| Pyroclastic (fragmental) | Tuff fragments less than 2 mm Volcanic Breccia (fragments greater than 2 mm) | | | |
| Rock Color (based on % of dark minerals) | 0% to 25% | 35% to 45% | 45% to 85% | 85% to 100% |

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Gabbro



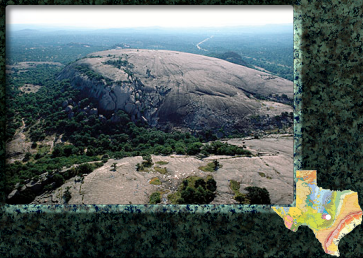
32

Granite



33

Enchanted Rock



34

Many granite outcrops form tremendous natural features.



35

Pegmatite



36

Next Lecture

Volcanos



37
