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Partially Melt Mantle

-Decompression → Mafic (Basaltic) – occurs at mid-ocean ridges, thinned lithosphere (crust), and hot spots (mantle plumes) – basaltic magma is the most fluid.
-Add Water → Felsic, Intermediate, Mafic -occurs at subduction zones – Intermediate is what makes it to the surface and makes Mt Hood Volcanoes- Felsic (stickiest lava) gets stuck underground and doesn't make it to the surface. Water changes the melting temperature – it's trapped in fractures in the rock –water is released when you hit a certain depth – it's a polar molecule, so it helps break bonds.
-Heat Transfer → Felsic composition crust – occurs under subduction zones- really hot magma winds through the little fractures and melts all the stuff around it, making bigger and bigger fractures, makes pathways for felsic melts to get to the surface.
Felsic Melts rarely make it to the surface

@ Subduction Zones- Get basalts, intermediate and felsic – what mostly erupts is intermediate.

Magma that doesn't make it to the surface:

-Will solidify into Rock
-These are called PLUTONS or IGNEOUS INTRUSIONS

Basalt – very high temp, low resistance to flow, thin and runny
more silica you add, the stickier and thicker the magma is, the more likely it is to solidify before reaching the surface. High Viscosity!
Decreasing mobility of lava:
Basalt → Andesites → Dacite → Rhyolite
Gas-rich- pyroclastic eruption (like the one in Iceland that is grounding flights)
Gas-poor – effusive eruption (lava flow)

Sills & Dikes are tabular plutons (tabular – like a table – flat)

-A Sill is parallel to the rock above and below it.
-A Dike cuts across (vertical)

What happens when magma intrudes into rock?

-Rock intruded into is "Country Rock" – could be anything. Heat from the magma will "bake" part of the country rock. Magma cools underground and has a coarse-grained (Phaneritic) texture.
Hot rock up against the cool rock – it'll cool quickly – so there is a "chill zone" – cools so quickly that sometimes there is obsidian formed. Sometimes a piece of the country rock survives the magma and is surrounded by it – called a "Xenolith". A piece of some rock inside the magma that hasn't melted.
Means you can see the interaction point – a very fine line.

How can you tell the difference between a sill and other rocks just sitting on top of a magma flow?

-If it's a sill it'll have the Bake Zone on the bottom and top.
Beacon Rock @ Columbia Gorge is an old Volcanic Neck! Cathedral Rock??

Lopolith – cup shaped – spreads between layers - sags
Laccolith – mushroom shaped – also spreads between layers – pushes up
Batholith – big body of magma – don't talk about it until it's exposed by erosion (little exposed piece is called a "stock")

Big blobs of granitic or dioritic (usually granitic) magma rising to the surface – they get stuck and form a large mass. Ones on the outside have cooled, in the middle still cooling, on the bottom, still liquid. USUALLY UNDER SUBDUCTION ZONE VOLCANO
Big mass of igneous rock – has uplift and erosion – some of the intrusion will erode, the country rock will erode
Batholith – Irregularly shaped pluton with greater than 100 square kilometers exposed area
Stock – Irregularly shaped pluton with less than 100 square kilometers exposed area
These names cannot be applied until it is exposed by erosion
-Sierra Nevada mountains – they are a batholiths – formed under subduction zone volcanoes a long time ago – granite, diorite – intermediate and felsic –

Things that change magma composition:

-Assimilation – dropped a piece of country rock into the magma and it melted
-Magma Mixing – one blob of magma can overtake another and mixes it up – mixing of 2 magmas
- Fractional Crystallization – opposite of partial melting- bring in a big pile of magma and begin to grow crystals and then the crystals settle out. The minerals settle out and get separated.

Nakhlites – meteorites – lava flow in Ontario that is 120meters thick and about 2.6billion years old – top of the flow is basaltic in composition – then gabbro, then pyroxene, then olivine. Almost identical in composition to the meteorite.

Can you make an ultramafic rock from a basaltic magma – yes!

Basalt Magma – typical eruption behavior (on land)
Fire Fountaining – gas-rich – pyroclastic – goes to spatter as it de-gasses (goes flat) this creates scoria – froth
Lava Lake – in central depression (caldera)
Lava Channels – roofs over to become lava tubes
Lava Flows – sort of a sheet

Fire Fountains – Fissure or Central Vent – spraying blobs of magma into the air and they cool into these little rocks – scoria (volcanic cinders, basaltic cinders) – often reddish or black – means it has seen oxygen.
-Fire Fountains produce cinder cones – steep sided because they build up around the central vent – usually asymmetrical.

As magma loses gas the fountaining gives way to spatter – this creates spatter cones – can be at a fissure or central vent. Spatter cones can have "dribblet spire"

Lava spills over/out of the vent and goes flowing down slope – skin of solidified rock
Lava in channels – concept of intracanyon flows – pre-existing stream channel – lava will flow there – inverted topography (Wright's Point – Eastern OR – stream deposits capped with a basalt lava flow –surrounding material has eroded, so now you have a mesa)

Lava channel with levees – the spillage forms levees to keep the lava in its channel
Eventually the levees connect up – if it roofs over it creates a lava tube.

Lava Tube – skylights, gutters

Tumulus – a lava tube where the plumbing gets backed up – pushes up on the roof and breaks it.

Lava Flows: pahoehoe and aa – basalt lava flows – 1st out of volcano very runny, very fast flowing, very thin skin that gets rumpled easily – as it goes on the skin gets thicker and the lava flows slower – skin gets more rocky and chunky –
Rumple – pahoehoe (pr: pa-hoy-hoy) – increase viscosity and get slower then→
Thicker skin – aa (pr: ah-ah)

Kipuka – piece of high up land –lava flows around it

Tree Molds – going around trees – setting them on fire, but also cooling as it goes

Vesicles mark the top of the lava flow – lava has gas that tries to escape – cooled pretty quickly – not pyroclastic –

As magma cools and de-gasses you start seeing the ropy skin breaking up into chunks – it becomes more viscous. SWITCH FROM PAHOEHOE to AA FLOW. Pile of rubble moving towards you – moves very slowly

Basaltic lavas typically build shield volcanoes – look like old fashioned roman shield – big broad low volcano – they are really big – the biggest on earth are shield volcanoes. They can also be small.