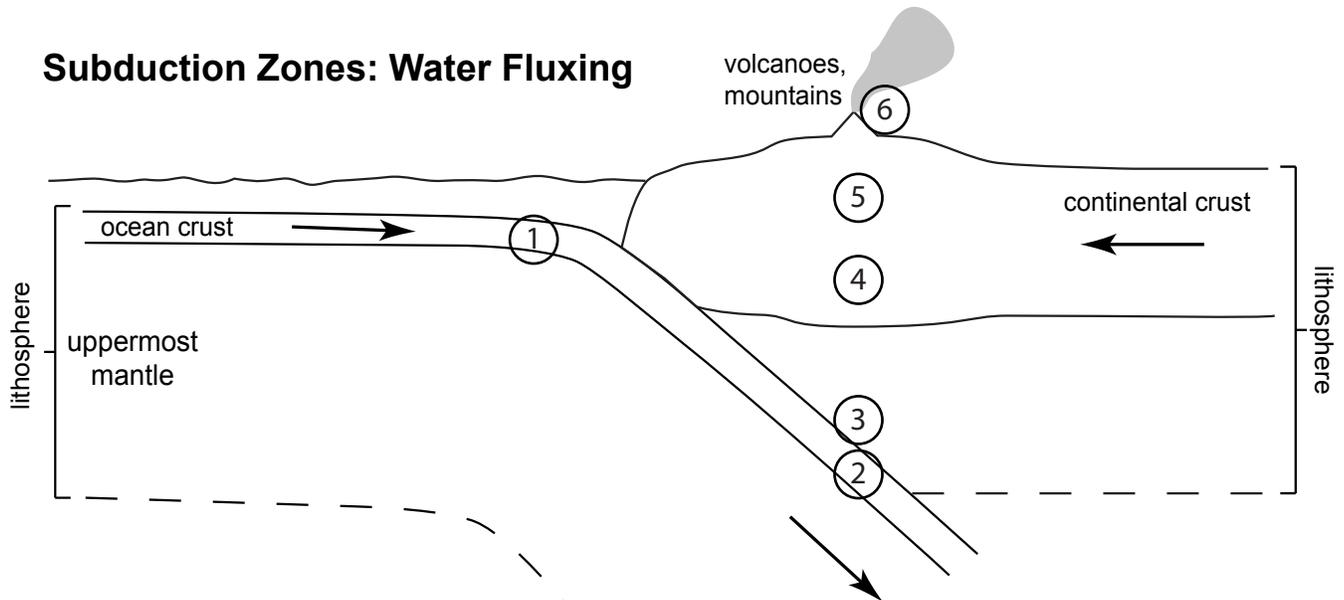


# Magma Formation in the Earth

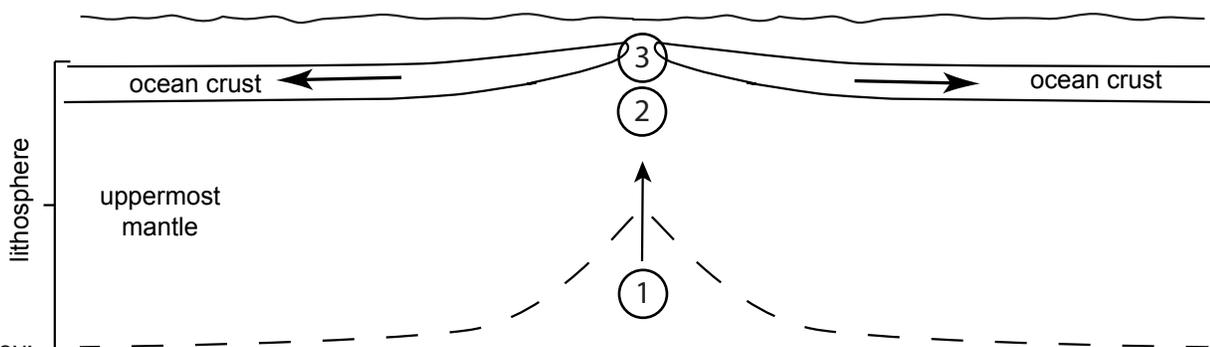
## Subduction Zones: Water Fluxing



Key:

1. Oceanic crust contains water in its basalt and the sediments that collect on top of it.
2. At depth - about 100 km (60 mi) - the water is cooked out of the subducted oceanic crust.
3. Water released from the subducted crust penetrates the mantle above it and causes **water fluxing** - the water lowers the melting temperature of the mantle rock. The ultramafic mantle rock **partially melts** to produce a **mafic composition magma**.
4. The mafic magma **assimilates** more felsic continental crust and **differentiates** to become, on average, **intermediate in composition** (often, some felsic magma is made, and some mafic magma persists).
5. **Some magma solidifies underground to form** intermediate (and some felsic) composition plutons. Over time, enough plutons form to create a **batholith**. Diorite (and some granite) rock is formed.
6. Intermediate (on average) composition lava is erupted - often **explosively**. **Andesite** (and some rhyolite) rock is formed.

## Divergent Plate Boundaries and Hot Spots: Decompression Melting



Key:

1. Hot mantle rock rises to fill the gap created by the diverging plates. At hot spots, mantle rock rises because it is hotter than surrounding rock, much the way wax rises in a lava lamp.
2. As the hot mantle rock rises, it feels less pressure (it decompresses), yet its temperature doesn't change much. This causes it to **partially melt** (about 20% of it melts). When ultramafic mantle partially melts, **mafic composition magma is formed**.
3. The mafic magma solidifies to form oceanic crust. Some of the magma erupts onto the seafloor to form **basalt**, some solidifies underground to form **gabbro**.

Notes: Some hotspots exist under/on continental crust - Yellowstone is a prime example. In that situation, intermediate and felsic composition magma - and rocks - can form, just as they do at subduction zones. But everywhere else, the magma at hot spots and divergent boundaries is mafic and nearly exactly the same composition.