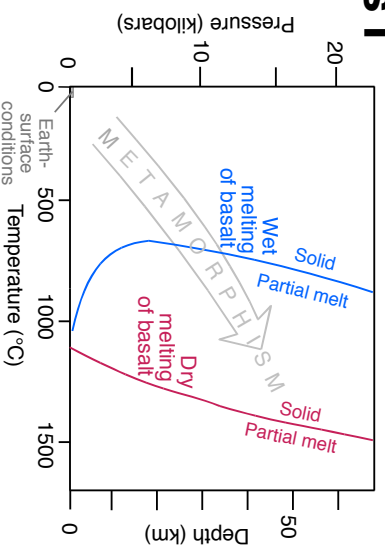


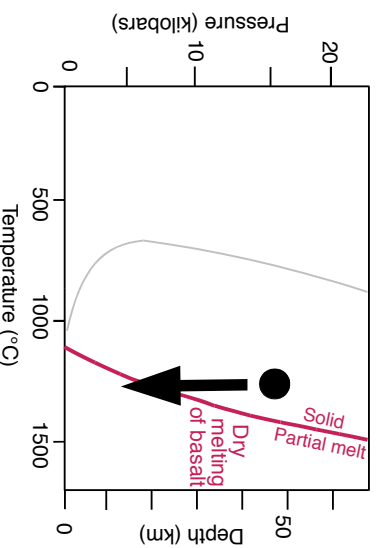
Origins of melts and magmas I

Melts (molten mineral material) and magmas (melt plus newly-formed crystals) cool to form igneous rocks. Places where igneous rocks form are not evenly distributed on Earth; instead, they are restricted to three general locations. This page explains those three general locations in terms of how melts originate. We begin with the diagram at right and move to the three diagrams below.

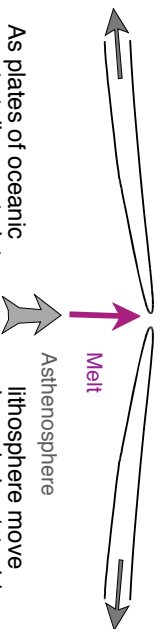


Along the dry-melting boundary, increased vibrational energy of atoms with increasing temperature breaks minerals apart to cause a transition to liquid (melting). Because these liquids are less dense than the corresponding solid minerals, decreasing pressure also favors melting, so that the boundary slopes as it does. Compared to the dry melting boundary discussed above, the "wet"-melting boundary falls at a lower temperature because H₂O molecules bond to the cations of minerals and help liberate those cations, breaking down minerals to generate melt.

The curves at left are only schematic and would move with changing rock composition and/or changing water content.

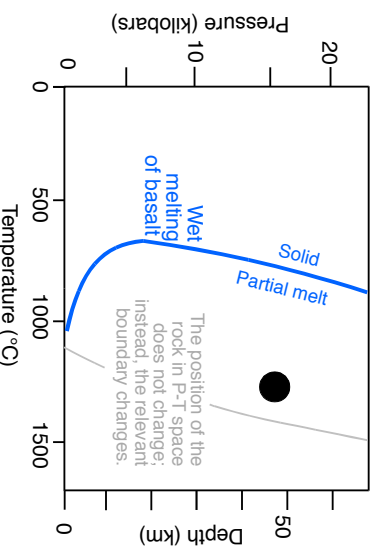


Pressure-release partial melting
at divergent plate boundaries

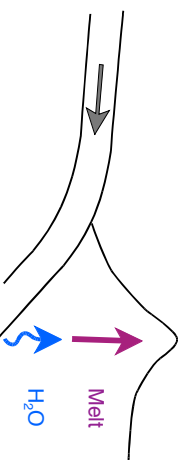


As plates of oceanic apart at divergent plate ocean ridges), underlying asthenospheric rock flows upward. Its upward movement requires a decrease in pressure that allows melting and thus produces melt. These melts form the Mid-Ocean Ridge Basalts (MORB) and underlying gabbros of the oceanic crust.

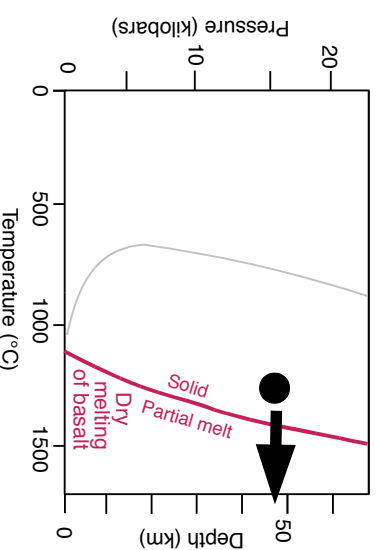
Note the role of moving oceanic plates in both of these origins of melts, which are volumetrically the two dominant sources of melts.



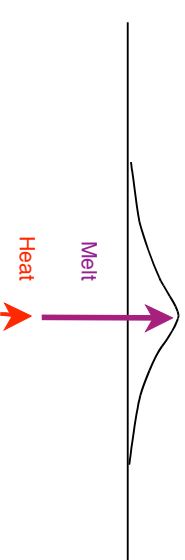
H₂O-induced partial melting
at convergent plate boundaries



Water released from the subducting oceanic plate at a convergent plate boundary induces melting that produces island arcs and continental arcs. The former are largely basaltic; the latter include both grano-dioritic intrusive rocks and basaltic to rhyolitic volcanics.



Thermal-plume-driven partial melting



Heat moving outward from Earth's core or lower mantle drives melting. This is the most intuitively obvious potential cause of melting ("add heat to make something melt"), but it is the least volumetrically significant of the three origins shown here.

For sources of the concepts shown here, and for more about partial melting, see Part II of this pair.