

Metamorphism and metamorphic rocks

The word "Metamorphism" comes from the Greek: Meta = change, Morph = form, so metamorphism means to change form. In geology this refers to the changes in mineral assemblage and texture that result from subjecting a preexisting rock to pressures and temperatures that are different from those under which the rock originally formed.

Metamorphism takes place at temperatures and pressures higher than 200 degree Centigrade and 300 mega Pascal (MPa). Rocks can be subjected to these higher temperatures and pressures as they become buried deeper in the Earth Crust. Such burial usually takes place as a result of mountain building processes called tectonic processes such as continental collisions or subduction.

Metamorphism takes place over a wide range of temperatures and pressures. The lower end of metamorphism is where the process of diagenesis ends and the upper limit of metamorphism occurs at the pressure and temperature of wet partial melting of the rock in question where rocks melts and forms magmas. Once melting begins, the process changes to an igneous process rather than a metamorphic process.

Grade of Metamorphism:

As the temperature and/or pressure increases on a body of rock we say that the rock undergoes pro-grade metamorphism or that the grade of metamorphism increases. Metamorphic grade is a general term for describing the relative temperature and pressure conditions under which metamorphic rocks form.

Low-grade metamorphism takes place at temperatures between about 200 to 320 degree Centigrade, and relatively low pressures. Low-grade metamorphic rocks are characterized by an abundance of hydrous minerals.

High-grade metamorphism takes place at temperatures greater than 320 degree Centigrade and relatively high pressure. As grade of metamorphism increases, hydrous minerals become dehydrated, by losing H₂O and non-hydrous minerals become more common.

Factors that Control Metamorphism: Temperature, Pressure and Composition

Metamorphism occurs because some minerals are stable only under certain conditions of pressure, temperature and chemical composition. When pressure and temperature change, chemical reactions occur to cause the minerals in the rock to change to an assemblage that is stable at the new temperature and pressure conditions. Temperature increases with depth in the Earth along the Geothermal Gradient. Temperature can also increase due to igneous intrusion.

Pressure increases with depth of burial, thus, both pressure and temperature will vary with depth in the Earth.

Bulk composition of the original rock also plays major role during metamorphism. Rocks that are made of simple composition will result less varied minerals assemblages. Where as rocks that have different composition will result in a variety of mineral assemblage.