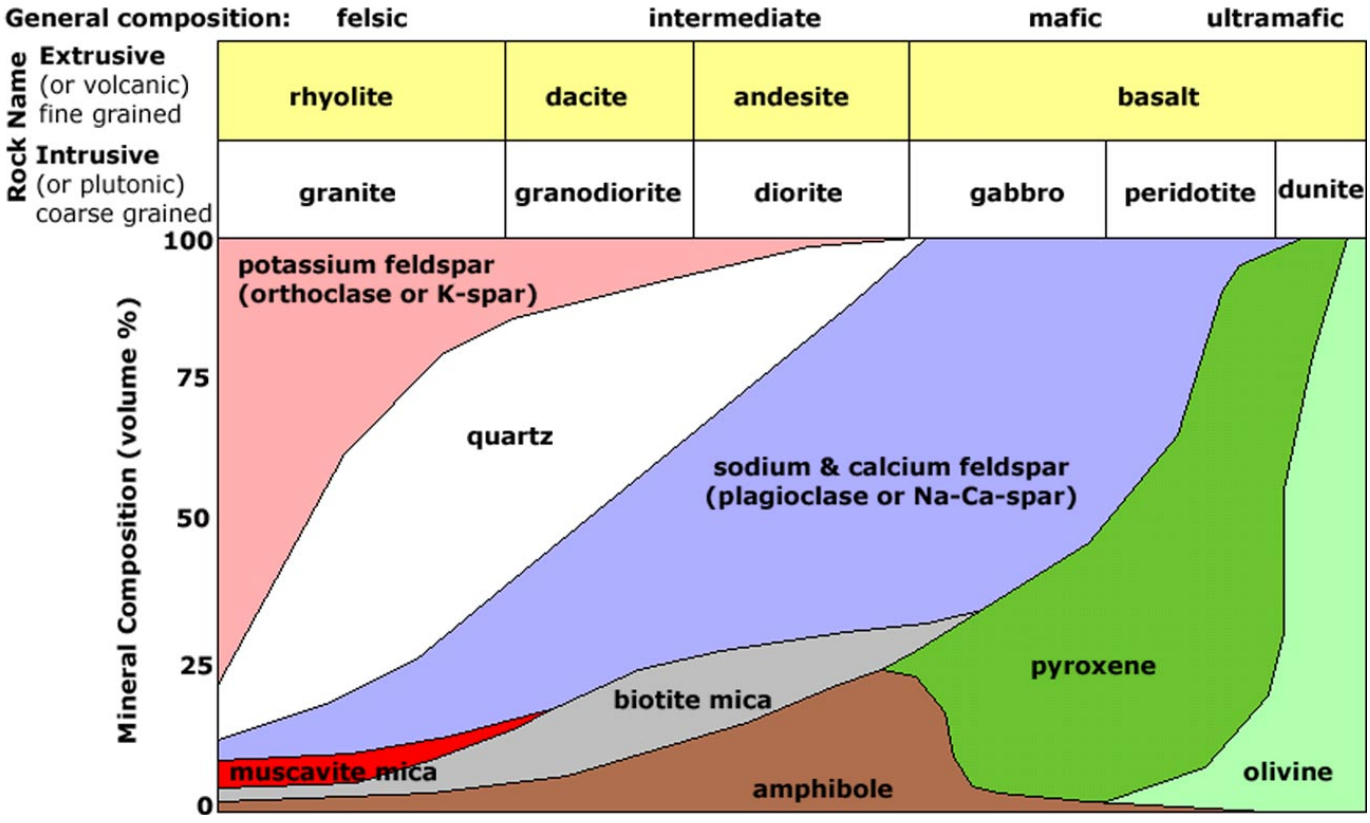
Classification of Igneous Rocks

Igneous rocks are classified by the geologic environment where they formed from the crystallization of molten material, and perhaps more importantly, by their mineral composition. Rocks that form underground are called intrusive igneous rocks, whereas rocks that form on the surface are called extrusive igneous rocks. Intrusive igneous rocks (like granite or gabbro) typically display visible mineral grains that are fairly easy to recognize with a little training. Extrusive rocks are more difficult to clearly identify because the mineral grains are typically invisible. However, the general composition of an extrusive rock is reflected by its color and density characteristics. General composition types include felsic (which is a mnemonic word derived from "feldspar" and "silica"), and mafic (which means rich in magnesium and iron, Fe). Felsic rocks tend to be light colored (white, pink, yellow), and are typically much less dense than mafic rocks that are typically dark (gray, brown, or black). A simplified igneous rock classification system is presented below.

The classification chart illustrates that rhyolite (a felsic extrusive rock) has the same mineral composition as granite (an intrusive igneous rock) and is composed dominantly of the minerals potassium feldspar (K-spar), quartz, and lesser amounts of plagioclase feldspar, mica, hornblende, and other minerals. Likewise, basalt (a mafic extrusive rock) has the same mineral composition of the mafic intrusive rock, gabbro.

This generalized composition of felsic and mafic can be subdivided into intermediate (between felsic and mafic composition), and ultramafic (rocks extremely enriched in magnesium and iron). Rocks of intermediate composition include diorite (intrusive) and andesite (the extrusive equivalent). Ultramafic rocks have special significance, in that they probably are derived from the mantle. They are relatively unstable on the Earth's surface, and are typically metamorphosed. In nature and in simplistic interpretation, igneous rocks that make up most continental crust typically have a felsic composition (such as rhyolite and granite). The mafic rock basalt is the dominant rock type that makes up most ocean crust. Rocks of intermediate composition are derived from the mixing of continental and oceanic crust. Interestingly, intrusive and extrusive igneous rocks of nearly every composition listed below can be found in the greater San Francisco Bay region—a reflection of its complex geologic history.



A general classification of igneous rocks.