

IV. COMPOSITION OF CRUST, MANTLE, AND CORE

4.1 CRUSTAL ROCKS

Lets say a little bit about the rocks that form the earth's crust and those we infer are in the mantle - again you will hear more next quarter, and in later courses! (*Petrology* is this field - the study of rocks)

Since we're interested in gross earth structure - we focus on *igneous* rocks those derived by cooling from a magma (whether on the surface or at depth). We're not interested in *sedimentary* or *metamorphic* rocks which are derived by reworking or altering igneous rocks. After all, the crust is a very small (volumetric) portion of the earth and in this class we're not interested in purely crustal processes since we really want to extrapolate to the mantle.

The classification of igneous rocks is a complex and involved business, lets just look at some simple ideas. Rocks can be classified a number of ways: the same chemical composition can have different names depending on how it was formed.

two names: extrusive (formed above surface - volcanic)
intrusive (formed at depth - plutonic)

Composition of Igneous Rocks in Weight %

INTRUSIVE (Extrusive)	GRANITE (Rhyolite)	DIORITE (Andesite)	GABBRO (Basalt)
SiO ₂	71	58	49
Al ₂ O ₃	15	17	18
Fe ₂ O ₃	2	3	3
FeO	2	4	6
MgO	1	4	8
CaO	2	7	11
Na ₂ O	4	3	2
K ₂ O	4	2	1
TiO ₂	0.4	1	1

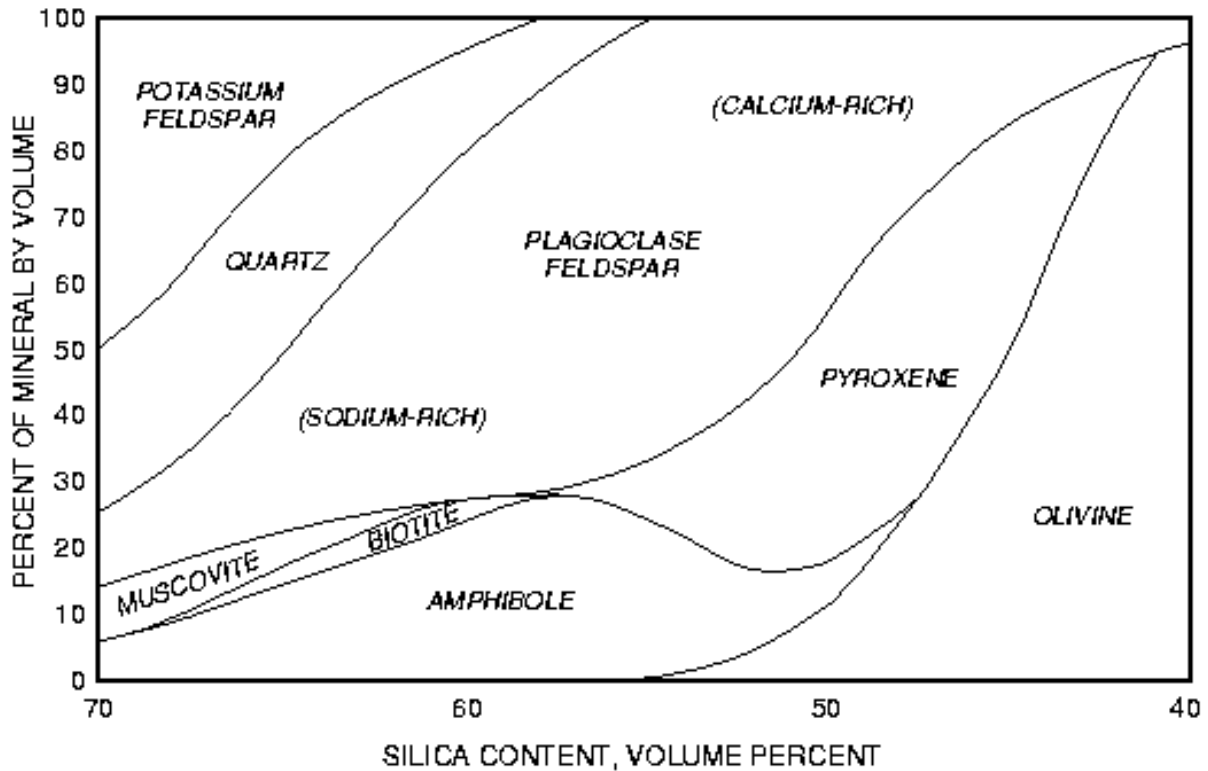
These make up most of the earth's crust: granite is the most common intrusive and basalt the most common extrusive. Naturally, many more rock types are named to provide finer distinctions.

The SiO₂ (silica) content is the key index here!

Note - basalt has much more iron and magnesium than granite, much less SiO₂!

Rocks really aren't discrete types they're continuous and their names indicate *ranges* of compositions.

EXTRUSIVE ROCKS: RHYOLITE DACITE ANDESITE BASALT KOMATIITE
 INTRUSIVE ROCKS: GRANITE GRANODIORITE DIORITE GABBRO PERIDOTITE



The upper continental crust can be thought of as mostly granite (grano-diorite)

The lower continental crust is considered different intermediate to basic rocks (i.e., less SiO₂ than the upper crust). There is no sharp transition between the upper and lower crust, so the boundary is unclear.

Oceanic crust - mostly basalt (gabbro)

These compositions tend to fit the seismic data

	α (P velocity, km/s)	ρ (g/cm ³)
granite	6.0	2.65
gabbro	6.8	3.0

