

Practical Geology for Engineering Students

Lab No.

Name of Student

Igneous Lab

The main job today is to use igneous texture and mineral composition to identify igneous rocks.

Your Book contains extensive information about texture and composition which could be briefed here as follows:

1-Igneous Textures:

Crystalline Rocks (composed of interlocking mineral crystals)

Phaneritic (coarse grained) e.g., granite, diorite, gabbro	Mineral crystals large enough to see and identify with hand lens.
Aphanitic (fine grained) e.g., rhyolite, andesite, basalt	Mineral crystals too small to see and identify without significant magnification
Porphyritic e.g., porphyritic rhyolite, porphyritic andesite, porphyritic basalt	Rock contains some mineral crystals that are much, much larger than the crystals in the rest of the rock (e.g., aphanitic rock with some clearly visible crystals). The large crystals are called phenocrysts.
Pegmatitic	Phaneritic texture with very large crystals (>3 cm). Granite pegmatites frequently contain exotic minerals such as the gemstones tourmaline, garnets, topaz and spodumene.

Non-Crystalline Rocks (not composed of interlocking mineral crystals)

Glassy (e.g., obsidian)	Transparent in thin slices. Light-colored minerals sometimes found in volcanic glass (e.g., snowflake obsidian)
Vesicular (e.g., scoria)	Rock contains large openings corresponding to the position of gas bubbles that were preserved when the lava solidified. Minerals sometimes form in the voids after the lava has cooled.
Frothy (e.g., pumice)	Rock contains many tiny openings like those in vesicular rocks, but much smaller. The openings lower the density of the rock enough that some frothy-textured rocks float in water.
Pyroclastic (e.g., tuff)	Rock composed of materials blown into the air during an explosive eruption. Individual fragments range in size from microscopic ash to boulder-sized bombs.

2-Mineral Composition:

Common minerals in igneous rocks comprise:

Mineral	Chemical Formula	Group	
Quartz	SiO_2	Oxides	
Muscovite	$\text{KAl}_2(\text{Si}_3\text{Al})\text{O}_{10}(\text{OH})_2$	Silicates	
K-Feldspar	KAlSi_3O_8	Silicates	
Plagioclase	$\text{NaAlSi}_3\text{O}_8$ (albite) – $\text{NaAl}_2\text{Si}_2\text{O}_8$ (anorthite)	Silicates	
Biotite	$\text{K}(\text{Mg,Fe})_3[\text{AlSi}_3\text{O}_{10}(\text{OH,F})_2]$	Silicates	
Hornblende	$\text{Ca}_2[\text{Mg}_4(\text{Al,Fe})\text{S}_7\text{AlO}_{22}(\text{OH})_2]$	Silicates	
Augite	$\text{Ca}(\text{Mg,Fe,Mn,Fe}^{3+}, \text{Ti, Al})_2(\text{Al, Si})_2\text{O}_6$	Silicates	
Olivine	$(\text{Mg,Fe})_2\text{SiO}_4$	Silicates	
Magnetite	Fe_3O_4	Non-Silicates	Oxides
Pyrite	FeS_2		Sulfides

Composition of Igneous Rocks

	Rock will be composed primarily of one or more of the following minerals:	Rock might contain 1 or 2 of the following minerals:
Felsic <i>granite, rhyolite, syanite</i>	quartz, K-feldspar, plagioclase (Na-rich) (no quartz in syanite)	muscovite, biotite, amphibole (e.g., hornblende)
Intermediate <i>diorite, andesite</i>	plagioclase feldspar, amphibole (e.g., hornblende)	pyroxene (e.g., augite), biotite
Mafic <i>gabbro, basalt</i>	plagioclase (Ca-rich), pyroxene (e.g., augite)	amphibole (e.g., hornblende) olivine, magnetite
Ultramafic <i>peridotite</i>	olivine	plagioclase (Ca-rich), pyroxene (e.g., augite)
<i>pumice, scoria, tuff, obsidian</i>	None	None (usually)

Steps of work

1- Using texture

- 1- Phaneritic and Pegmatitic textures $\Rightarrow$ Indicate plutonic (Intrusive) origin.
- 2- Aphanitic, vesicular, Porphyritic, glassy, frothy and pyroclastic textures $\Rightarrow$ Indicate Volcanic (Extrusive).

2- Using mineral composition:

- 1- Presence of quartz indicate acidic composition.
- 2- Presence of feldspars (frequently zoned plagioclase) and amphiboles together (with no or scarce quartz) indicate intermediate composition.
- 3- Presence of Ca-rich plagioclase feldspars and pyroxenes in absence of quartz indicate basic composition.
- 4- Presence of olivine and/or pyroxene and/or amphibole in quiet absence of both quartz and feldspars indicate ultrabasic composition.

3- Using Grainularity (Grain size):

Fine – medium - coarse

- 1- Absence of grains (glasses, froths) indicate volcanic origin.
- 2- Fine grained crystals ($< 1\text{mm}$ across) also indicate volcanic origin.
- 3- Medium grained crystals ($1\text{-}3\text{ mm}$ across) indicate hypabyssal origin (i.e. formation in dykes or sills).
- 4- Coarse grained crystals ($> 3\text{mm}$) indicate plutonic (intrusive) origin (i.e. formation in batholiths, Lacoliths, Stocksetc).
- 5- Huge crystals (in decimeter scale or more) indicate late formation in the magma.

Sample No	Texture	Origin Plut/Vol	Mineral composition	Type Acid/ Int/ Bas/Ult	Name
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

Signature of Demonstrator

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Sedimentary Lab

1-Description of Terrigenous Soils and Rocks*:

Grain Size	Class	Deposits (Soil)	Texture	Rocks
> 2 mm	Rudaceous	Gravels	v. coarse - Rounded	Breccia
			v. coarse - Angular	Conglomerate
2- 1/16 (0.06) mm	Arenaceous	Sands	Siliceous Cement	Sandstone
			Calcareous Cement	
			Hematitic Cement	
1/16 - 1/156 (0.06)-(0.004) mm	Aargillaceous	Silts	Fine grained	Mudrocks
< 1/256 mm		Clays	massive	
			Fissile	Shale

Colour:

Texture:

Grain Size: > 2 mm, 2- 1/16 mm, 1/16 - 1/156 mm or < 1/256 mm

Roundness: Angular, Subangular, Subrounded and Rounded.

Structure: Massive, Laminated, Fissile

Cement:

- Siliceous (colourless/white and doesn't react with HCl).
- Calcareous (colourless/white and reacts with HCl with effervescence).
- Hematitic/calcareous (Red coloured & reacts with HCl with effervescence).
- Hematitic/ Siliceous (Red coloured and doesn't react with HCl).

Fossil content:

- Fossiliferous
- Non-fossiliferous

Type:

Name:

* Samples to be studied: Many samples under the 8 names as in the shaded columns of the above given table

2-Limestones

Colour:.....

Structure:

Carbonate mud (Fine crystalline limestone).

Oolites

Skeletal remains (Shells, corals,etc)

Cement:

Siliceous (Hard and weak reaction with HCl)

Calcareous (Soft white and reacts with HCl with strong effervescence).

Hematitic (reddish stained)

Fossil Content:

Fossiliferous

Non-fossiliferous

Type:.....

Name:.....

Samples to be studied: Many samples under only the following names:

1-Chemical Limestone

2-Biochemical Limestone

3-Evaporites

Colour:

Mineral Composition:

Fossil Content:

Fossiliferous

Non-fossiliferous

Type:.....

Name:.....

Samples to be studied: Many samples under only the following names:

1-Gypsum

2-Anhydrite

3-Rock Salt

Sample No	Colour	Texture/Structure	Cement	Type Terr/Chemical/L.S	Name
1					Gravel / Rudaceous Soil
2					Sands/ Arenaceous Solil
3					Argillaceous soil
4					Conglomerate
5					Breccia
6					Sandstone
7					Siltstone
8					Shale
9					Claystone
10					Chemical Limestone
11					Biochemical Limestone
12					Gypsum
13					Ahhydrite
14					Rock Salt

