LAB 3: TEXTURES AND IDENTIFICATION OF IGNEOUS ROCKS

OBJECTIVES:

1) to become familiar with the properties important in recognizing and classifying igneous rocks;
2) to become familiar with the textures characteristic of igneous rocks;
3) to become familiar with the mineralogy of common igneous rocks.

INTRODUCTION:

Igneous rocks crystallize from molten magma or lava. The starting composition of the magma, the manner and rate at which it travels to the surface, and the rate at which it cools all influence the composition and characteristics of the rock. Igneous rocks are classified on the basis of two main characteristics: texture (including grain size and grain shape) and mineralogical composition.

The basis of rock classification is described in Marshak, Interlude B (p. 144-151), and igneous rock characteristics are described in Pellant p. 32-33 and Marshak, p. 169-171.

WHAT TO DO IN THIS LAB

In **Part 1**, you will review and identify the common igneous rock-forming minerals.

In **Part 2**, you will study the textures and mineralogy of a variety of igneous rocks and learn how to identify them.

In **Part 3**, you will identify a group of unknown igneous minerals and rocks.

WHAT YOU ARE EXPECTED TO KNOW

A. Be able to recognize the textures below, and to explain their meaning in terms of the rock's origin and/or cooling history.

B. Be able to identify the common igneous minerals and rocks listed below. Be familiar with the general composition of the minerals (what sorts of ions do they contain? are they high or low in silica?), and know the type of igneous rocks in which they are likely to be found.

TEXTURES

coarse-grained (intrusive)
fine-grained (extrusive)
aphanitic
porphyritic (Pellant p. 200)
fragmental(pyroclastic) (204-5)
glassy
vesicular

MINERALS

quartz
orthoclase feldspar
plagioclase feldspar
amphibole (hornblende)
pyroxene (augite)
biotite mica
muscovite mica
olivine

ROCKS

Granite (Pellant p.180-181)
Rhyolite (Pellant p. 196)
Diorite (Pellant p. 187)
Andesite (Pellant p. 199-200)
Gabbro (Pellant p. 189-190)
Basalt (Pellant p.202-3, 206-7))
Peridotite (Pellant p. 193-195)
Obsidian (Pellant p.197)
Pumice (Pellant p. 205)

Texture refers to the way the mineral grains fit together. The texture of an igneous rock reflects its cooling history, but may also be influenced by its chemical composition.

crystalline granular (phaneritic) texture means that the individual grains are visible, more or less the same general size, and interlock like elements of a jigsaw puzzle. Crystalline granular rocks may either be *coarse-grained* (slow cooling) or *fine-grained* (more rapid cooling). Most crystalline granular rocks are plutonic (intrusive) in origin.

aphanitic texture means that the individual grains are too small to recognize or identify. Aphanitic igneous rocks are of volcanic (extrusive) origin.

porphyritic texture refers to large, more-or-less well-formed crystals (*phenocrysts*) surrounded by a fine-grained or aphanitic material (the *groundmass*). Porphyritic textures are common in volcanic rocks, but are occasionally found in plutonic rocks.

glassy texture indicates very quick cooling at the earth's surface— so quick that no crystals had a chance to form.

vesicular textures are ones with bubble holes (vesicles) formed by escaping gas. They indicate a volcanic origin.

tuffaceous, fragmental or ***pyroclastic*** texture refers to igneous rocks formed from glass shards, fragments of crystals, and small hunks of pre-existing (often aphanitic) igneous rock, commonly all more-or-less welded together. Rocks with this texture are the products of explosive eruptions, and include deposits of volcanic ash and glowing-ash avalanches (ignimbrites).

Mineralogy reflects the chemical composition of the igneous rock. We can divide igneous rock compositions into three large groups:

silicic (or felsic) rocks are generally *light-colored* (white, tan, pink, light grey) and are high in silica, high in potassium and aluminum, and low in iron and magnesium. The dominant minerals in these rocks are quartz and orthoclase feldspar. Biotite, amphibole, and plagioclase feldspar may also be present in small quantities. You should not find olivine in silicic rocks.

mafic (or basic) rocks are usually *dark-colored* (black or dark green)and are low in silica, and high in iron, magnesium, and calcium. Mafic rocks are composed chiefly of pyroxene and calcic plagioclase; *ultramafic* rocks consist of pyroxene and olivine. You should not find quartz in mafic rocks.

intermediate rocks are usually medium to dark brown or grey (sometimes blackish) and are intermediate in silica, iron, and magnesium content. The dominant minerals are pyroxene and sodic plagioclase, but biotite and amphibole are also common.

PART I REVIEW OF THE IMPORTANT MINERALS FOUND IN IGNEOUS ROCKS

Examine the specimens numbered 1 through 10 and determine the mineral name of each. You should note the properties *you* used to identify each mineral. Check your identifications against the posted answers.

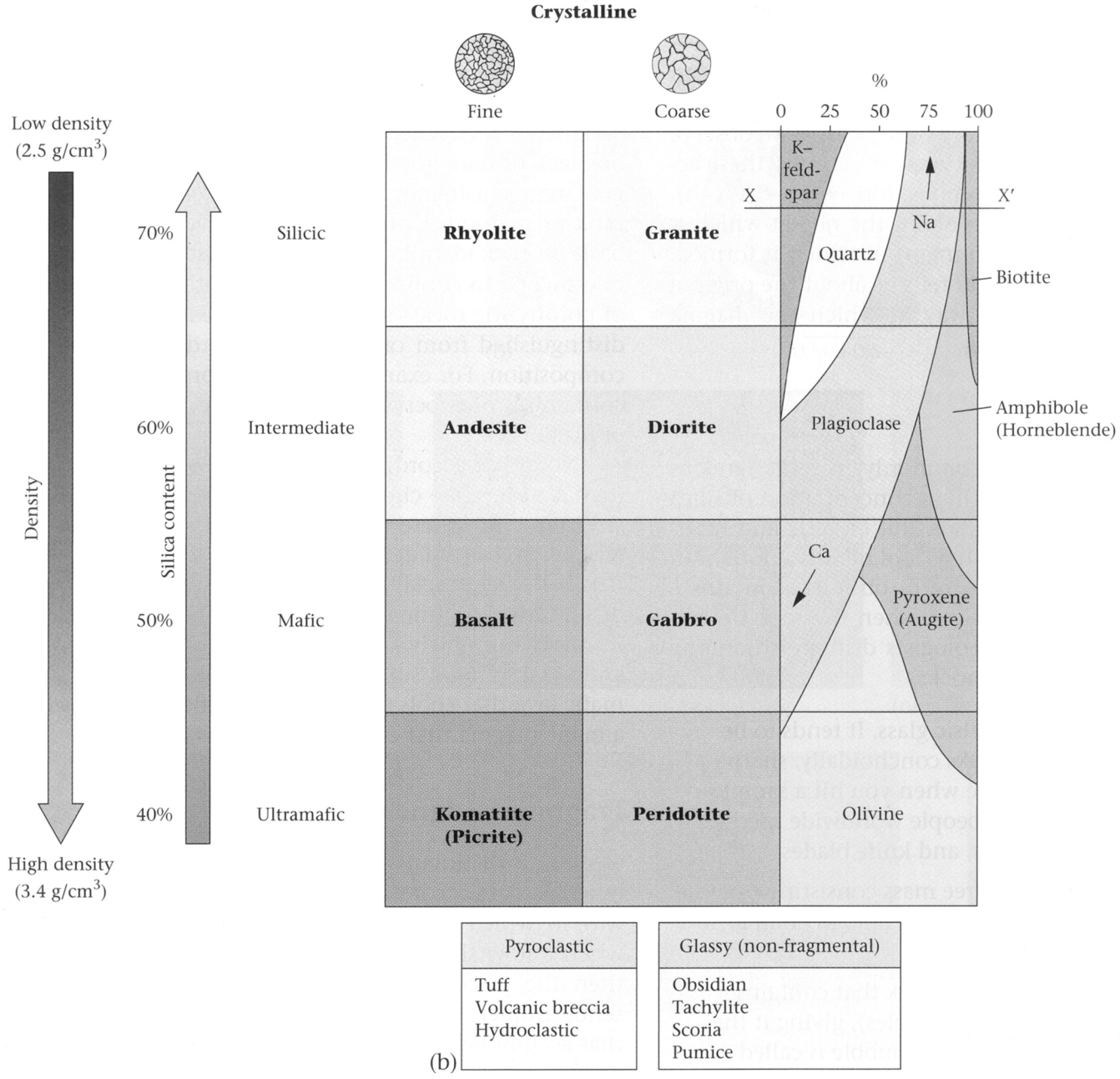
PART I : IGNEOUS ROCK-FORMING MINERALS

Number	Name	Properties you used to identify sample
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

PART II IGNEOUS ROCK IDENTIFICATION

Examine the igneous rock specimens labeled 11 through 22. For each specimen determine:

a) the rock's *texture* (Pellant, p. 32-33, Marshak, p. 153-156)
b) the rock's *mineralogy* (if you can identify the minerals)
c) the rock's general *compositional class* (i.e, silicic, intermediate, or mafic)
d) the *name* of the rock.



PART II: IDENTIFICATION OF IGNEOUS ROCKS

Number	Texture	Minerals present that you can see	Compositional class	Rock name
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				

Questions: What characteristic distinguishes andesite from andesite porphyry?

How do you recognize a tuff, and how does this rock form?

What minerals are commonly found in peridotite?