GLY 4310C

LAB 7

INTRUSIVE IGNEOUS ROCKS, PART 2

Granite, Alkali Feldspar Granite, Granodiorite, Quartz Monzonite, and Monzonite

These intrusive (plutonic) rocks correspond to fields on diagram 2-2 of Winter. These rocks are generally richer in silica and alkali feldspar than those studied in Lab 6. More information about these rocks is included in Chapter 13 and 14 of Moorhouse.

GRANITE - Intrusive igneous, plutonic. Medium to coarse-grained plutonic rock containing between 20% to 60% quartz, feldspar (the plagioclase to plagioclase plus alkali feldspar (P/A+P) ratio is between 10 to 65%), and small amounts of biotite, hornblende or other silicates. K-spar may be orthoclase and/or microcline. The plagioclase is sodic, either oligoclase or andesine. Rocks of this composition are scarce and the definition is often broadened, for example by including quartz monzonite. The alkali feldspar is commonly microcline perthite (mixture of microcline and plagioclase). In some perthites, the albite and K-feldspar are completely separated, possibly due to recrystallization. The quartz is almost always anhedral in granites. The quartz grains often contain inclusions. Biotite is usually brown or brownish green and often contains inclusions. Hornblende is dark green and pleochroitic. Biotite may form a rim around the hornblende. If pyroxene (diopside) is present, hornblende may form a rim around the pyroxene. Muscovite may occur in patches around the biotite. Many granites are foliated. The name is from the Latin *granum*, meaning grain.

ALKALI FELDSPAR GRANITE - Intrusive igneous, plutonic. Medium to coarse-grained plutonic rock containing between 20% to 60% quartz, feldspar (the plagioclase to plagioclase plus alkali feldspar (P/A+P) ratio < 10), and small amounts of biotite, hornblende or other silicates. The plagioclase is often albite or sodic oligoclase. K-spars are strongly perthitic or anorthoclase. Biotite, if present, is iron-rich. Amphiboles include hastingsite, arfvedsonite, or riebeckite. Pyroxenes include aegirine-augite or aegirine.

GRANODIORITE - Intrusive igneous, plutonic. Similar in composition to granite (20-60% quartz) except that P/A+P is between 65-90%. The plagioclase is typically andesine or oligoclase, and is often zoned. The zoning may be oscillatory - thin shells with abrupt borders, alternating in composition. The alkali feldspar is often orthoclase or orthoclase perthite, but may be microcline. Hornblende is the most common mafic mineral, followed by biotite. Pyroxene is rare. The plagioclase is euhedral to subhedral, rectangular in form, with borders corroded by quartz and alkali feldspar. Hornblende may occur in prisms or in ragged plates.

MONZONITE - Intrusive igneous, plutonic. The feldspar in these rocks is between ⅓ and ⅔ microcline or orthoclase, with the remainder being plagioclase (P/A+P is 35-65). These rocks contain 0-5 quartz. The plagioclase is sodic. The mafic minerals usually comprise 10-40% of the rock and are generally biotite, hornblende, and/or pyroxene (generally augite). Zoning of the plagioclase is fairly common. Zoning is best developed when monzonite occurs in stocks or on the borders of batholiths. Quartz monzonite is similar in composition except that the rock contains between 5 to 20% quartz. The name is for Monzoni in the Tyrolean Alps.

QUARTZ MONZONITE - Intrusive igneous, plutonic. The feldspar in these rocks is between ⅓ and ⅔ microcline or orthoclase, with the remainder being plagioclase (P/A+P is 35-65). These rocks contain 5-20 quartz. The plagioclase is sodic. The mafic minerals are generally biotite, hornblende, and/or pyroxene (generally augite). An alternative name is adamellite.

APLITE - Intrusive igneous, hypabyssal and diaschistic. A light-colored hypabyssal igneous rock characterized by fine, anhedral grains. Colors include white, cream, yel-low, reddish, or gray. The term "aplite' used without modifier, generally means a rock similar in composition to granite, with the essential minerals being quartz, K-feldspar, and sodic plagioclase. However, the term "aplite" is sometimes used to represent fine-grained igneous rocks phases whose composition ranges from granitic to gabbroic. Rock names are usually used as adjectives, i.e. gabbroic aplite. Aplites are often associated with pegmatites, either as border zones around the pegmatite, or as aplitic dikes. Aplites form by the rapid loss of volatiles from a late-stage water-rich magma. The loss of volatiles causes a rapid crystallization into many small crystals. The term is derived from a Greek *haploos*, simple, referring to the simple composition.

ALKALI-FELDSPAR GRANITE - (Alkali granite is an older, non-preferred name). A granite with the P/A+P $\leq$ 10%. The mafic minerals associated with alkali-feldspar granite are often alkaline varieties such as riebeckite or aegirine.

PEGMATITE - Intrusive igneous, hypabyssal and diaschistic. An exceptionally coarse grained rock, generally of granitic composition. Grain size is often very uneven. Found in tabular dikes, lenses, or veins. Composition is quite variable. May consist of quartz and K-spar, or may include many accessory minerals. Possible accessory minerals include rare minerals with the following ions: beryllium, boron, chlorine, fluorine, lithium, molybdenum, niobium, phosphorous, sulfur, tantalum, tin, tungsten, uranium, zirconium, and the rare earth elements. The presence of some of these minerals may make the pegmatite an ore. Pegmatites commonly form at the margins of batholiths and represent the last, most hydrous portions of the magma to crystallize. Although generally of granitic composition, pegmatite facies of many other plutonic rocks are known. The name of the other rock type is than used as an adjective, i.e. ijolite pegmatite. Pegmatites may grade rapidly into aplites if the volatiles are lost. The name is from the Greek *pegma*, meaning framework.

TERMS:

The following list of terms are associated with rocks from this laboratory assignment. You will probably be familiar with some of these terms already. You should learn any terms that you are not familiar with as they may be tested on lab quizzes or the midterm.

Cunniform - Having the shape of a wedge. Composed of or written in wedge-shaped characters.

Diaschist - Rocks in small intrusions which are differentiates, that is, are of different composition than the parent magma. Both pegmatite and aplite are diaschistic.

Graphic granite - A coarse to very coarse granite consisting almost exclusively of quartz and K-spar. Large crystals of the two minerals intergrow so that in cross-section the intercalates of quartz have the appearance of cunniform, semitic, or runic characters. From the Greek *graphein*, to write.

Leucogranite - A light-colored granite. Generally rocks with the prefix leuco have less than 5% mafics, but that is not a rigid requirement. Specially does not imply that a rock

Runic - Characters of an alphabet, probably derived from Greek and Latin, and used by Germanic peoples from the third to thirteenth centuries.

Semitic - Any or all of a branch of the Afro-Asiatic language family which includes Hebrew, Aramaic, Arabic, and Ethiopic.

Assignment:

1. Examine any two of rocks number 1,2,3,4,5,6, or 7 in thin section. Prepare a labeled sketch of each selected thin section, being sure to label the sketch with magnification and either CN or PP. Identify the major minerals, and write a concise description of the petrography of the rock. This will be handed in at the beginning of the following lab.

Examine all of the rocks in hand specimen. The following rocks (numbered) from Wards North American Rock Set are particularly good type examples.

1. Biotite granite
2. Muscovite-biotite granite
3. Biotite-hornblende granite
4. Alkali granite
5. Aplite
6. Quartz monzonite porphyry
7. Granodiorite
22. Monzonite

2. Estimate the mineral content of any one of the following specimens by identifying the minerals present and the approximate percent concentration of each. Are the names listed appropriate? This is to be turned in as a formal writeup at the next class meeting. You need to carefully examine the specimen, identify each visible mineral, and estimate its percentage. The total should be 100%. If some of the grains are too small to be identified, list the remaining percentage as aphanitic.

Granodiorite, Grant County, New Mexico, #319
Monzonite, Ortiz Mountains, Madrid, Santa Fe County, New Mexico, #321
Granodiorite, Woodson Mountain, San Diego County, California, #341
Quartz Monzonite, Organ Mountains, Dona Ana County, New Mexico, #342
Biotite Granodiorite, North Carolina

3. Additional samples of various rocks, illustrating many of the terms described, are also available in the lab, and should be examined. **(DO NOT USE THESE FOR THE EXERCISE UNDER #2)**

Graphic granite (white)
Graphic granite, Southern Black Hills, South Dakota (Pink)
Graphic granite pegmatite, Kingman, Arizona
Pegamatite late stage, Southern California batholith
Aplite, near Joshua Tree monument, California
Aplite, Pala, California
Granite, Salisbury, North Carolina
Pegmatite gneissen phase, San Bernardino Mountains, California

4. Examine at least one interference figure from a mineral in this weeks lab. Determine the optical class and sign. If biaxial, estimate 2V. If uniaxial, determine whether the figure is centered or not. If it is not centered, approximately how far off the C axis are you viewing the figure? Prepare a labeled sketch of the figure, including the mineral name. Show the figure to the GTA. Do a different mineral each week.

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