

METAMORPHIC ROCKS, PART 4

Contact and Dynamic Metamorphic Rocks

The rocks in this lab are formed either by contact metamorphism or by dynamic metamorphism associated with movement along a fault. Contact metamorphism is sometimes called thermal metamorphism. Temperature is increased due to the heat lost by an intrusive body.

Hornfels- A fine grained, massive rock. (Massive means the minerals have no preferred orientation.) One specimen you will examine is a cordierite hornfels, with porphyroblasts of cordierite, a magnesium aluminum silicate. Tremolite hornfels represents the hornblende hornfels facies, while enstatite almandine hornfels represents an even higher grade of metamorphism, the pyroxene hornfels facies.

Skarn- Skarns are lime silicate rocks, which form by thermal alteration of limestone, either calcitic or dolomitic. One of the specimens you will examine is a garnet-wollastonite skarn. The garnet is andradite, a calcium-iron garnet. Most Ca-rich garnets form in calcareous rocks of either contact or regional metamorphic origin. Like all garnets, it is isometric and will remain in extinction under crossed nicols. Wollastonite is a pyroxenoid, a mineral type that is a single chain silicate, like the pyroxenes, but with a distinctly different crystal structure. The other example of skarn is cordierite-anthophyllite skarn. Anthophyllite is a magnesium-iron orthoamphibole. It is usually fibrous, but may be poikiloblastic. Anthophyllite is often found in Mg-rich metasomatic rocks, associated with cordierite. Cordierite is favored by low-pressure, high-temperature situations.

Tremolite-Talc Schist- This schist contains two minerals, tremolite and talc, which are usually found in contact metamorphic rocks. Tremolite is a calcium-magnesium amphibole, and is usually fibrous or bladed. It is often altered to talc, a hydrous magnesium sheet silicate. Tremolite is generally restricted to low-grade metamorphic rocks. The calcium in tremolite becomes calcite upon alteration. Talc is a common metamorphic product of impure dolomitic limestones. It commonly forms in shear zones and thus may form a schist. See Figure 201 in Moorhouse.

Epidosite - The epidosite is indicative of the contact metamorphic facies albite-epidote hornfels facies. Hornfels is a massive rock that has been completely recrystallized during contact metamorphism. Epidote is often formed by metasomatism. The fine-grained textures of hornfels' makes detection of replacement difficult to impossible so other evidence would be needed to decide if this rock were of metasomatic origin.

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.

Cataclasite - Any metamorphic rock formed principally by mechanical deformation or cataclastic metamorphism. From the Greek *kata*, meaning down, and *klastos*, broken.

Friable - A rock or mineral that is crumbles naturally or is easily broken, pulverized, or reduced to powder, such as a soft or poorly cemented sandstone.

Mylonite - Exceedingly fine-grained, chert-like metamorphic rock, without cleavage but with a streaky or banded structure resembling flow structures in some volcanic glasses. The rock is formed by extreme milling and complete pulverization of rocks along major fault zones under strong confining pressure. Original rocks are of varied types. From the Greek *mule*, meaning mill, and alluding to the milling of the rock.

ASSIGNMENT:

1. Examine two of the rocks numbered 75, 82, 88, or 98 in thin section. Prepare a labeled sketch of two thin sections, 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.

- 71 Cordierite hornfels
- 75 Garnet-wollastonite skarn
- 82 Talc-tremolite schist
- 88 Cordierite anthophyllite skarn
- 98 Epidosite

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

Enstatite-almandine hornfels

Hornfels #350 San Pedro Muntain, Santa Fe County, New Mexico

Wollastonite with Idocrase Skarn - Llano, Texas

Granite Cataclasite - Northeast of Borrego Springs, California

Mylonitized Granite - Lylte Creek, San Gabriel Mountains, California

3. 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.