**Ge 114**

**Hand Specimen Lab Exercise 3**

Silicates I: Orthosilicates and Disilicates

**Items in bold type will be written up and handed in as part of the lab report.**

Goals:

* Learn about the silicate classification system for ortho- and di- silicates
* Identify 15 major minerals in these two groups
* Learn about metamictization in zircon

I) **Explain the structural characteristics of minerals in each of these groups**. Looking at one or more of the mineralogy textbooks will be helpful.

 II) The minerals to be studied in this lab are:

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Orthosilicates:

*Garnet* (pyrope, grossular, almandine, andradite, uvarovite, spessartine)

*Olivine* (fayalite, forsterite)

Zircon

Titanite

Kyanite, Andalusite, Sillimanite

Staurolite

Topaz

Disilicates:

Epidote

Plus one mineral of your choice from the collection, not on this list

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**Prepare a brief written description of your characterization of these minerals, in the form of a table. This table should include the following:**

- Mineral name, formula, and SiO2 polymerization (i.e., tectosilicate, orthosilicate, etc.). For *mineral group*, you may list a general formula for the group and distinguish the minerals in that group by noting the elemental substitutions into each site for each mineral.

- Physical properties and attributes such as: cleavage or fracture, crystal form or habit, luster, color, density to the hand, and possibly magnetism, taste, and other properties if relevant. You may describe the general physical properties of all minerals in a *mineral group* once, instead of for each mineral, but be sure to include how to distinguish one mineral from another in a particular group.

- Indicate the three most important diagnostic properties of each mineral.

- Include variations in these properties among different specimens of the same mineral in the Dana and working collections.

- Geological occurrences (rock types) and economic importance.

III) Metamict Zircons

Reference: Metamict Minerals: A Review by Richard S. Mitchell, in lab drawer.

Large amounts of U and Th can substitute into the zircon (ZrSiO4) structure. This makes zircon a useful mineral for dating the rocks in which it is found, using the radioactive decay of 238U, 235U, and 232Th.

Examine the thin sections of normal and metamict zircon under crossed polarizers (slides labeled “---” and “metamict 6500”). **Which (normal or metamict) is isotropic under crossed polarizers? What is the crystal system of zircon? What happens to the structure of zircon when U and Th decay, forming alpha particles?** (Check out figure 1. A., p.216 in reference)

Your TA may demonstrate how a Geiger counter reacts to a few large zircons from George’s personal collection.

Compare the color of the natural zircon #2 and the color of the heat-treated zircon #2. **Which color do you think is due to the U4+ ion, and which do you think is due to “self-irradiation”? Why?**

Other orthosilicates and disilicates are in the Dana Collection. You may examine these as your time allows and interests dictate!