Stillwater Igneous Complex

The Stillwater Igneous Complex (SIC) is a Precambrian sheet-like, basic intrusion located in the Beartooth Mountains of Montana (near the YBRA field camp). It exhibits mineralogic and compositional layering on many scales. A brief description of the intrusion is attached along with a description of the locations of samples for which we have thin sections. A more complete description and interpretation is given in Hess (1989, Chap.13).

Most of the minerals in these rocks are either plagioclase, olivine, orthopyroxene, augite, or chromite. Look at as many SIC thin sections as you can. In addition,

1. Describe completely two of the thin sections from the following group (SIC-3, SIC-4, SIC-5, SIC-6, SIC-11, SIC-12, SIC-14), including one or more labeled photomicrographs. Be sure to include in your description the cumulus and/or intercumulus nature of the minerals observed.

2. Determine the olivine composition and plagioclase composition for at least one sample (not necessarily the same one) from the following (SIC-3, SIC-4, SIC-8, SIC-11, SIC-12, SIC-13, SIC-14, SIC-15, SIC-16, SIC-17). Explain how you reached your compositional determinations. We will check the samples with the SEM after break to see how well the optics methods worked. Compositions determined for the minerals in various samples will be posted on the course web page.

3. Layered igneous intrusions are discussed in many books as a layer-cake record of the crystallization history of a mafic magma body. Based on the mineral compositions and on information from the reading, explain why the SIC cannot be the result of simple crystal settling, in order, of the crystallization products of a single magma body.
Rocks from the Stillwater Complex

1. Cordierite-hypersthene-quartz hornfEls. Just below the basal contact. Ridge above the Benbow Mine. (Hess, p. 52-55)


4. Poikilitic harzburgite. Ultramafic zone. Mouat Mine dump, from the interval between G and H chromitite layers. (Jackson, p. 5-8)

5. Granular harzburgite. Ultramafic zone. Mouat Mine dump as No. 4. (Jackson, p. 508)

6. Feldspathic poikilitic harzburgite. Ultramafic zone. Most specimens show some euhedral olivine crystals. Mouat Mine dump as no. 4. (Jackson, p. 5-8)

7. Serpentinized poikilitic harzburgite. Ultramafic zone. Benbow Mine dump. (Jackson, p. 5-8; Hess, p. 58)

8. Gabbro pegmatite. Ultramafic zone. Feldspar, 2 pyroxenes. Mouat Mine dump as No. 4. (Jackson, p. 8)


11. Bronzitite. About 1000 feet above base of the Bronzitite member of the Ultramafic zone. Benbow Road. (Jackson, p. 5)

12. Norite. About 1000 feet above base of Norite zone. Benbow Road. (Hess, 70-75)

13. Feldspar-rich gabbro. Lower gabbro zone. Benbow Road (Hess, p. 75-81)


15. Troctolite. Base of anorthosite zone. (Olivine altered). Benbow Road. (Hess, p. 81-83)


17. Olivine gabbro. Anorthosite zone. Picket Pin Mountain. (Hess, p. 81-83)
