

Beneath the Stillwater Complex: Petrology and geochemistry of quartz-plagioclase-cordierite (or garnet)-orthopyroxene-biotite \pm spinel hornfels, Mountain View area, Montana

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ABSTRACT

A 50 m drill core (core no. 383-334) collected from the contact metamorphic aureole in the Mouat Ni-Cu prospect in the Mountain View area of Stillwater County, Montana, exhibits evidence of in situ fluid-absent biotite dehydration melting and local back reaction of melts derived from metasediments and metavolcanics. The drill core was investigated to characterize the mineral assemblages and their textures, to search for evidence of partial melting, and to determine mineral and whole-rock geochemistry to provide an understanding of the petrogenesis of the hornfels close to the contact with the Stillwater Complex. The rocks investigated are predominantly quartz-plagioclase-cordierite-orthopyroxene-biotite \pm spinel hornfels, Fe-Cu-Ni sulfides, and Fe-Ti oxides. One sample contains garnet ($\text{Alm}_{73-77}\text{Py}_{17-20}\text{Sps}_3\text{Grs}_4$) in addition to cordierite. Three samples contain cordierite-hercynite symplectites surrounded by a narrow mantle devoid of orthopyroxene, plagioclase, and biotite that are roughly ovoid to lenticular in shape. Partially melted samples show back reaction between crystallizing melt and restite such that retrograde skeletal intergrowths of biotite and quartz in the mesosome were developed. Average *T-P* conditions of hornfels and melt genesis are 786 °C and 3.7 kbar. Back reactions that produced biotite occurred at somewhat lower temperatures. Whole-rock geochemistry suggests that the protolith of the hornfelsic rocks was likely a mixture of greywacke and additional intermediate to mafic volcanogenic components.

Keywords: Stillwater Complex, hornfels, partial melting, back reactions