

A REGIONAL STUDY OF PRESSURES, TEMPERATURES, AND AGES OF METAMORPHOSED PELITIC ROCKS IN SOUTHWESTERN MONTANA

DEANNA GERWIN, Smith College

The mountain ranges in southwestern Montana are some of the northwestern most exposures of Precambrian basement rock of the Wyoming province. The Tobacco Root Mountains are located in this area and have been extensively studied (Brady et. al., 2004) providing new information and questions about the regional geologic history, particularly during the Big Sky Orogeny at 1.77-1.72 Ga. The following is a regional study of metamorphosed pelitic rocks from the Highland, Ruby, and Gravelly Mountain Ranges, which are adjacent to the Tobacco Root Mountains, in order to record the extent and character of Big Sky metamorphism of rocks of similar bulk composition located in different parts of the northern Wyoming Province.

Meta-pelite samples were collected across the region. Thin sections of the meta-pelites were analyzed using a petrographic microscope to identify the minerals present and relevant textures. Using the scanning electron microscope at Smith College, two samples with the assemblage garnet-biotite-quartz-plagioclase-aluminosilicate were analyzed for geothermobarometry using Spear and Kohn's Program Thermobarometry (2001 version). One sample from the Wall Creek area in the Gravelly Mountains and one sample from Camp Creek in the Highlands were sent to the University of Massachusetts for microprobe Th-Pb chemical age dating of monazite grains.

In general, metamorphism seems to be lower grade in the Gravelly Range than in the Highland or Ruby Ranges. For the southern Gravelly Range, a clockwise PT path around the triple point is hypothesized, with andalusite forming first, then kyanite and finally sillimanite reaching pressures and temperatures of at least 540°C and 3kb (Spear, 1993). A rock from this area gives a date of 2570±45 Ma. The Ruby Range assemblages give a minimum temperature of about 550°C and pressures from about 2.5 to 6.25 kb (Spear, 1993). Results from the Thermobarometry program yield temperatures from about 475-685°C and pressures from about 1.8-5.8 kb. A sample from the Highland Range yields a Th-Pb chemical age of 1819 ± 28 Ma except for two analyses which show a younger average age of 1737± 20 Ma. All samples from the Highland Mountains show evidence of high-grade metamorphism. Many samples contain sillimanite and some show evidence that the reaction muscovite+quartz→ K-spar+ aluminosilicate has occurred. This constrains the temperature to at least 600°C (Spear, 1993). Geothermobarometry has yielded results are lower than those expected based on mineralogy in both the Highland and Ruby Range samples, possibly due to re-equilibration during cooling.

REFERENCES:

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