PETROLOGY OF BANDED IRON FORMATION AND PHYLLITE IN THE STANDARD CREEK CONTACT AUREOLE, SOUTHERN GRAVELLY MOUNTAINS, MONTANA

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The Wyoming Province is an area of Precambrian rocks that underlie much of SW Montana and Wyoming today (Harms et al., 2004). The Gravelly Mountains are a north-south trending exposure of the Precambrian basement in the Wyoming Province in southwest Montana. Giletti's (1966) Line divides the Gravelly Range into a northern part, where the effect of the Big Sky Orogeny at 1.8 Ga is recorded in upper amphibolite facies metamorphic rocks, and a southern part, in which lower-grade metamorphic rocks reveal only older Ar-Ar ages (2.4-2.7Ga.). The Standard Creek contact aureole represents a sequence of sedimentary units that have experienced both low-grade regional metamorphism and contact metamorphism as a result of the intrusion of a gabbro into banded iron formation and a porphyroblast-rich phyllite. The time of the intrusion in relation to the regional metamorphism is unknown.

It is hypothesized here that the regional metamorphism is concurrent with the intrusion of the gabbro. The degree of deformation of iron formation increases with proximity to the gabbro. Samples from close proximity to the gabbro exhibit larger grain size, increased reaction band thickness, and diverse mineral assemblages, which can include quartz, magnetite, ferrohornblende, grunerite, and ferroactinolite. The mode and coarseness of grunerite increases with proximity to the gabbro. Quartz and magnetite dominate rocks at the periphery of the aureole. Grunerite, ferrohornblende, and ferroactinolite dominate rocks closest to the gabbro. These features suggest that the rocks were still experiencing the effects of the regional metamorphism and had increased temperature and ductility at the time of the intrusion. The disappearance of magnetite and quartz and the growth of grunerite and ferrohornblende in proximity to the gabbro require the addition of water, reduction of some of the iron, and sources of Ca, Na, and Al. Calcite in some samples of banded iron formation could have provided the calcium necessary to produce ferrohornblende. The source of the Na and Al is still unknown. The lack of minnesotaite, which is unstable above 300° C and the presence of grunerite, which is unstable above 700° C, places the temperature of the banded iron formation between these bounds.

The porphyroblast-rich, blue-gray phyllite is composed of muscovite, quartz, graphite staurolite, chlorite and subhedral porphyroblasts of andalusite ranging in size from 1 to 3 cm and surrounded by muscovite rims 2-3 mm wide. The rock fabric is crenulated and contains refolded-folds. In one sample staurolite porphyroblasts with muscovite rims have a overgrown and preserved a pre-existing crenulated graphitic fabric. In other samples graphite bows around the andalusite crystals suggesting that the rock was deformed after or simultaneously with the growth of andalusite. The mineral assemblage staurolite + andalusite + chlorite + muscovite + quartz + graphite from the phyllite places pressure temperature constraints for this rock between 2 and 4 kbars and between 460° C and 540° C (Spear, 1993). A sample of phyllite from near the Standard Creek Gabbro was sent to the University of Massachusetts for Th/Pb dating. Monazites from the matrix of this sample give a preliminary date of 2548± 29.6 Ma.

REFRENCES

Harms, T.A., Brady, John B., Burger, Robert H., and Cheney, John T., 2004, Advances in the geology of the Tobacco Root Mountains, Montana, and their implications for the history of the northern Wyoming province, in Precambrian Geology of the Tobacco Root Mountains, Montana: Geological Society of America Special Paper 337, p.227-243.

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