PhD Dissertation
Department of Environmental Science and Policy
George Mason University

Candidate: Cynthia A. Kearns
Defense Date and Time: March 5, 2018, 3:00 pm
Defense Location: EXPL 3301
Title: The Mineralogy and Mineral Chemistry of the Henryton Pegmatite, Patapsco State Park, Carroll County, Maryland

Dissertation Director: Dr. Julia A. Nord
Committee: Dr. Michael Wise, Dr. Greg Foster, Dr. M'bark Baddouh

ABSTRACT

The textural, mineralogical and chemical characterization and classification of a pegmatite provides insight to its origin and its relationship to the thermotectonic history of a region. This is the first comprehensive study of a Maryland pegmatite, the Henryton pegmatite, one of the largest (approximately 5 by 0.25 km) mapped in the state during the 1940's. Field mapping examined the nature of the pegmatite-host contacts and textural and zoning relationships. The pegmatite intrudes amphibolite facies, kyanite grade, Proterozoic to Cambrian, Loch Raven or Oella schist, with concordant and discordant contacts. Distinct, textural pegmatite zoning (border, wall, core, etc.) was not observed, however coarse grained (> 3 cm) pegmatite pods and zones were surrounded by fine grained pegmatite. Crosscutting pegmatite dikes and dikelettes were also present. Evidence of ductile (shearing) and brittle deformation indicates syntectonic to late tectonic emplacement. Mineral identification was confirmed using XRD, EDS and thin section analysis. The pegmatite mineralogy is simple, consisting of smoky quartz, white, grey and pink perthitic microcline, white albite and apple green muscovite with accessory garnet (almandine-spessartine), sodic beryl, fluorapatite and zircon. Major and trace element chemistry of large feldspar and muscovite samples, determined by FUS-ICP, FUS-MS and TD-MS, was used to further investigate pegmatite zoning and enrichment trends. K/Rb values, an indicator of fractionation, range from 151.01-317.48 and 141.59-275.28 for microcline and muscovite, respectively. These are high values signify a primitive pegmatite. Neither microcline nor

muscovite are enriched in rare earth elements. Microcline and muscovite trace element trends plotted against K/Rb show an increase in Rb, Ga, Cs, Be, Tl, Pb and Ta and decrease in Ba, Sr, Eu, Nd and to a lesser extent La and Ce however, spatially, no large scale chemical enrichment trends are evident. This suggests a chemically homogenous pegmatite.

The Henryton pegmatite is classified as a muscovite pegmatite based on its simple mineralogy and the metamorphic pressure and temperature conditions of the host. Comparison of feldspar and muscovite trace element trends in the Henryton pegmatite to whole rock analyses of the younger Woodstock, Guilford and Ellicott City plutons, reaffirm the unlikely genetic relationship between the plutons and the pegmatite. Due to a lack of chemical data for comparison, it remains unclear if the pegmatite was formed from partial/complete melting of the host by anataxis, or melt derived from the Baltimore gneiss. The Henryton pegmatite was emplaced syntectonically to late tectonically as a poorly evolved, homogenous, primitive magma. Emplacement likely occurred following Taconic structural doming as a result of post tectonic decompression and extension. This investigation provides a groundwork for future Maryland pegmatite studies.