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Conference:

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Textural and cluster compositional analyses and the geothermobarometry of the complex phenocrysts from the mafic alkaline volcanic rocks of the West Eifel Volcanic Field, Germany

UNIVERSITY OF NEW BRUNSWICK

THESIS DEFENCE AND EXAMINATION

in Partial Fulfillment

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by

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in the Department of Earth Science

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via MS TEAMS

Examining Committee

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Abstract

Textures and mineral compositions of volcanic rocks record information about cooling, mixing and reaction processes within magma chambers that feed volcanoes. Clinopyroxene, a common mineral in mafic and intermediate volcanic rocks is particularly useful. This thesis describes and interprets the complex textures of a phenocryst assemblage from monogenetic volcanoes at Gossberg, Hahn, Hangelberg, Neunkirchen, and Oberstadtfeld in the West Eifel Volcanic Field, Germany (WEVF). The dominant textures are: dissolution surfaces, oscillatory zoning, sector zoning, sieve texture, patchy texture, and flame texture and the phenocrysts are classified based on the dominant texture in the phenocryst cores. Cluster analysis of major element compositional data revealed that nine out of the thirteen phenocrysts host cores that are xenocrysts (clusters 1 and 6) whose compositions do not match any published clinopyroxene compositions from the WEVF. The remaining clusters (clusters 2-5) crystallized under equilibrium or near-equilibrium conditions from the magma that erupted at surface. These clusters show a compositional progression from high Mg# (clusters 4 and 2) to intermediate Mg# (cluster 3) to low Mg# (cluster 5) that fits well with a fractional MELTS model developed using samples from the same area of study. Clinopyroxene thermobarometry shows that samples crystallized within a temperature range of 1148-1305±27 °C and a pressure range of 3.0-10.3±1.4 kbar. The PT distributions suggest that temperature and pressure of crystallization increase from SE to NW of the WEVF, though other locations in the south of the volcanic field should be studied to confirm this hypothesis. Magma mixing and fractionation control the formation of complex textures during crystal growth. Cluster progressions of 5 samples from Gossberg, Hahn, and Oberstadtfeld suggest magma mixing. This suggestion is supported by Mg# and temperatures that show abrupt increases instead of a decrease during the development of the phenocrysts.